Service Manual

TM25S / TM30S

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1. Handling components that are sensitive to electrostatic discharge (ESD)

To prevent ESD-sensitive components (e.g., printed circuit boards) from being damaged, please handle the components in the following steps:

● Wear an anti-static wrist strap before replacing ESD sensitive components and make sure the bracket is always connected to ground when replacing components.

● Hold the protective cover for the component's edge connect and avoid touching any exposed part.

● Drop the replaced component into an antistatic bag

2. Safety information

DNAGER：
Identifies an imminently hazardous situation that, if not avoided, is likely to result in serious injury, and might result in death or severe property damage.

WARNING:
Identifies a potentially hazardous situation that, if not avoided, will result in minor or moderate injury, and might result in serious injury, death, or significant property damage.
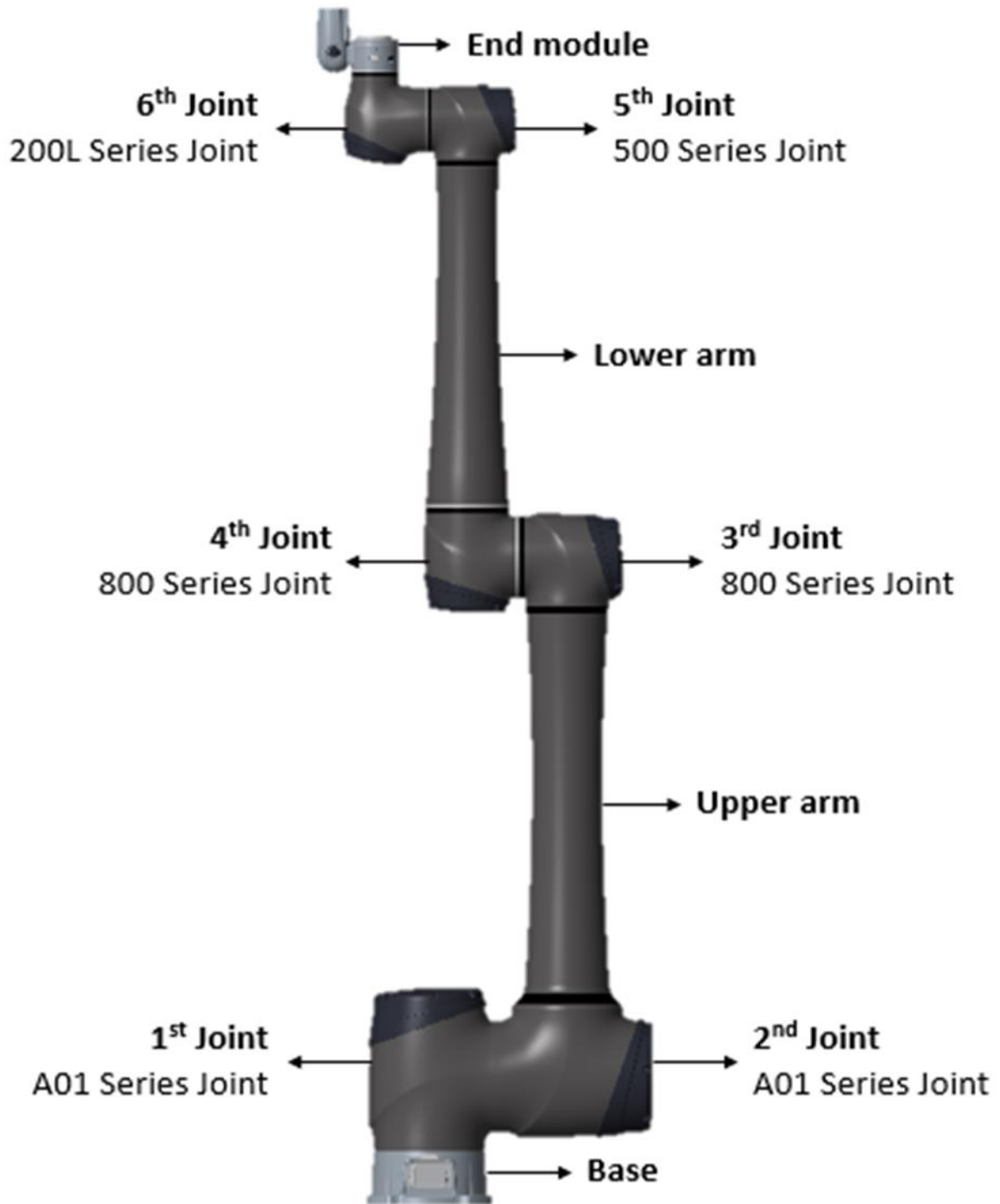
CAUTION:
Identifies a potentially hazardous situation that, if not avoided, may result in minor injury, moderate injury, or property damage.

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3. Description of Robot and control box parts

3.1 TM25S/TM30S：Robot Spare parts

End module

6th Joint
200L Series Joint

5th Joint
500 Series Joint

Lower arm

4th Joint
800 Series Joint

3rd Joint
800 Series Joint

Upper arm

1st Joint
A01 Series Joint

2nd Joint
A01 Series Joint

Base

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3.2 TM25SX/TM30SX：Robot Spare parts

End module

6th Joint
200L Series Joint

5th Joint
500 Series Joint

Lower arm

4th Joint
800 Series Joint

3rd Joint
800 Series Joint

Upper arm

1st Joint
A01 Series Joint

2nd Joint
A01 Series Joint

Base

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3.3 A01 Series Joint

Screw-M4L35

Cover

Screw-M8L18

Joint A01

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3.4 800 Series Joint

Screw-M3L6

Cover

Screw-M6L20

Joint 800

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3.5 500 Series Joint

Screw-M3L6

Cover

Screw-M5L20

Joint 500

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3.6 200L Series Joint

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3.7 End module

Camera module

Light module

End module PCBA

End module with camera

End module PCBA

End module with X Series robot

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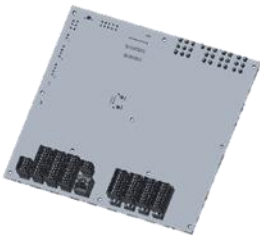## 3.8 Control Box

| IPC | Relay board | Power eater |

| Patriot power board | 48V PSU *2 | 24V PSU |

| SSD (with RTX) | Stick |

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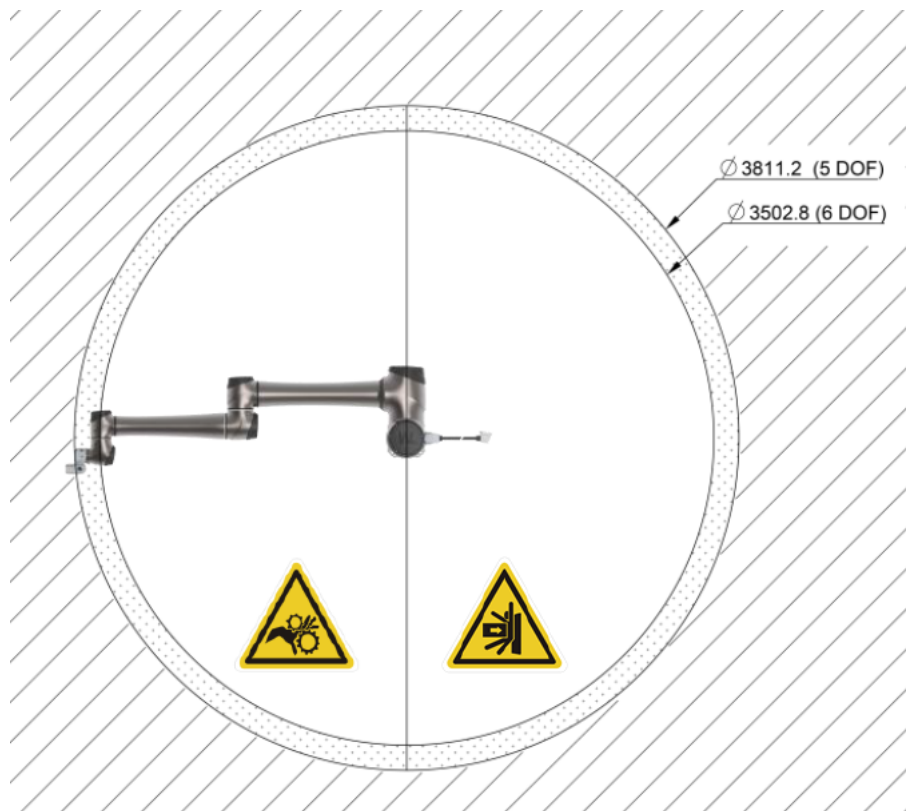## 4. TM25S/TM30S Maintenance Notes

4.1 When performing lifting, dismantling, maintenance, and calibration operations, it is recommended to place the robot in a spacious area. The following are the suggested space requirements:

4.2 For lifting or transporting robots, please refer to the "Moving the package robot" section in the hardware manual.

4.3 When it is necessary to rotate joint in an unpowered state, please refer to the "Joint Movement Without Drive Power" section in the hardware manual.

5. Tool list

5.1 Recommended Tool List for TM25S Maintenance

Contact Techman to purchase tools.

Name	Physical Reference	Specification	Model	Remarks
Ratchet Torque Wrench		20~100 N.m (200~1000 kgf.cm)	KANON N100QLK	Used for installation and removal A01 Series Joint
Linkage		at least 400mm Techman Robot	Techman Robot	linkage is used in conjunction with a ratchet torque wrench and a T45 Torx screwdriver to disassemble the A01 Series Joint.

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Name	Physical Reference	Specification	Model	Remarks
Magnetic torx Bit		T45		Used for installation and removal A01 Series Joint
Cut-Resistant Gloves		Features anti-slip and cut-resistant protection		Used to protect personnel's hands and provide anti-slip functionality
Soft Shell Cap		NA		Used to protect the head of maintenance personnel
Steel Toe Safety Shoes		NA		Used to protect the feet of maintenance personnel
Crane		500-1000kg length 2.5m height 3m	PORTA GANTRY 500kg	Used for moving the robot
lifting jig		Techman Robot	Techman Robot	Used to secure onto the A01 Series Joint, facilitating the crane lifting or handling of personnel after disassembling the joint
TM25 maintenance platform		Recommended Specifications: **Length: 90cm** **Width: 90cm** **Weight: 100kg**		Please refer to the hardware manual for the robot base hole positions and dimensions. When assembling, make sure to secure the bottom swivel feet
Shacke		weight 2T width 20mm		Install on the lifting jig so that the rope can lift the joint.
Eye bolt		M8 x L15mm		Install on the lifting jig so that the rope can lift the joint.

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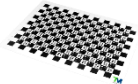
Name	Physical Reference	Specification	Model	Remarks
48V PSU		DC48V & 4A	Refer to Hardware manual	Used for operating a robot without drive power. Refer to hardware manual for settle the power souce.
Torque screw driver		6 – 26 kgf·cm	TOHNICHI 26RTD	Used for assembling A01 Series joint cover
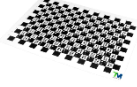
5.2 Tool List Commonly Used for Other Arm Models (TM5S, TM7S, TM12S, TM14S)

Name	Physical Reference	Specification	Model	Remarks
Open end wrench		5.5 mm		Used for IO module
Open end wrench		8 mm		Used for 500 Series Joint
Open end wrench		10mm		Used for 800 Series Joint
Hex socket screwdriver		5.5 mm		Used for IO module
Hex socket screwdriver		8 mm		Used for 500 Series Joint
Hex socket screwdriver		10mm		Used for 800 Series Joint
Torque wrench		5.5 mm 20 kgf·cm	TOHNICHI 50CL-MH	Used for IO module
Torque wrench		8 mm 92 kgf·cm	TOHNICHI 150CL-MH	Used for 500 Series Joint
Torque wrench		10mm 250kgf-cm	TOHNICHI 225CL-MH	Used for 800 Series Joint
Wrench head		SH8D × 5.5 5.5 mm	TOHNICHI SH8D*5.5	Used for IO module
Wrench head		SH8D × 8 8 mm	TOHNICHI SH8D*8	Used for 500 Series Joint
Wrench head		SH10Dx10 10mm	TOHNICHI SH10D*10	Used for 800 Series Joint
Torque screw driver		6 – 10 kgf·cm	TOHNICHI 10RTD	Used for Cover, Control box
Torx bit		T10		Used for Joint cover

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Name	Physical Reference	Specification	Model	Remarks
Hex bit		Bit 2.5mm x length 100mm		Used for outer cover of camera module
Hex wrenches		M1.5–M10		Used for Base and Control box
Extension bit Holder		1/4 inch At least 150mm magnet type is recommended		Used for internal box's fixed screws..
Hex socket bit		M10		Used for internal box's fixed screws, magnet type is recommended.
Phillips screw driver				Used for control box components
Tweezer				Used for removing cables
Adjestable spanner		8 inch		Used for robot cable
Diagonal cutting plier				Used for cutting cable ties
Long nose plier				Used for removing cables
Cable tie		120 × 2.5 mm^2		Used for securing wires
Cable tie		150 × 3.6 mm^2		Used for securing wires
Multimeter				Used for checking voltage and circuit
Precision screwdriver set		T06151		Used for screws
Electrical tape		Width: 18mm		Used for wrapping around camera cable connectors
USB flash drive				Used for Windows recovery
Dongle key			Techman Robot	Must contain authorization key of maintenance
2-cm Plate calibration		40 cm × 30 cm	Techman Robot	Used for camera calibration

Name	Physical Reference	Specification	Model	Remarks
1-cm Plate calibration		20 cm × 15 cm	Techman Robot	Used for camera calibration
TM Landmark			Techman Robot	Used for Kinematic calibration and Hand-eye calibration

6. Assembly and Disassembly Guide for Robot

6.1 Quick maintance quide

    6.1.1 To ensure operational safety, disassembly of Joint 1 and Joint 2 requires the collaborative effort of at least three people. Disassembly of other components requires a minimum of two people working together.

    6.1.1 Before disassembly, ensure that the robot is completely powered off completely and that both the external power cord and robot cable have been disconnected.

    6.1.2 Before disassembly, remove the robot from the platform and place it horizontally on a non-hard surface (e.g., blanket or sponge pad).

    6.1.3 Before disassembly, take photos to record the status and wiring configuration. These photos will serve as reference points during the reassembly process.

    6.1.4 Follow the right-hand rule when disassembling and installing screws.

6.2 Disassembly and assembly of Joint cover and Joint rubber

    6.2.1 Joint cover disassembly: To disassemble the joint cover, use a hex cap screwdriver to loosen the four hexagonal socket head cap screws (Fig. A). Then, gently remove the cover by hand, being careful to keep the O-ring in the groove.
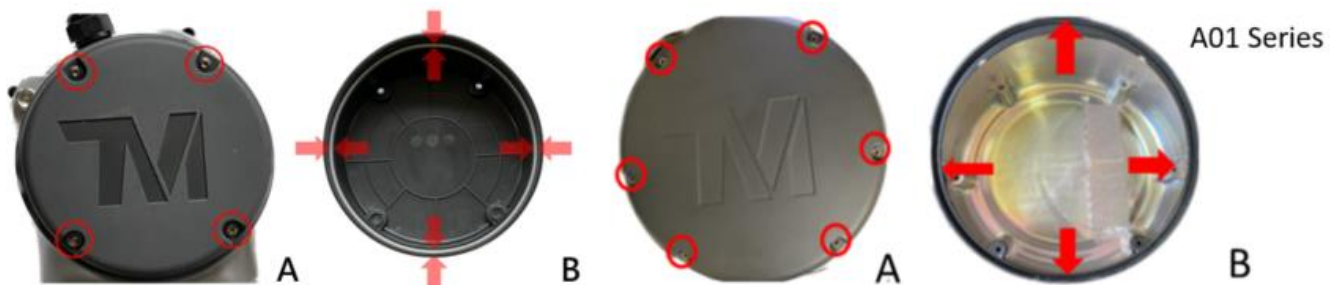
    6.2.2 Joint cover assembly: To assembly the joint cover, ensure that the O-ring is in the groove (Fig. B) and tighten the four socket head cap screws using a torque screwdriver and a socket head torque screwdriver.

CAUTION:
Use the correct torque to tighten the screws according to the table below. Insufficient torque may result in inadequate sealing of the joint cover. Excessive tirque during screw tightening may cause damage to the joint cover.

Torque specifications for Joint screws				
Joint Type	Screw Type	Torque Value (Kgf.cm)	Torque Value(Nm)	Total Screws
200L series	M3L6 TORX SOCKETHEAD CAP	6	0.6	4
500 series	M3L6 TORX SOCKETHEAD CAP	6	0.6	4
800 series	M3L6 TORX SOCKETHEAD CAP	6	0.6	4
A01 Series	M4L35 TORX SOCKETHEAD CAP	25	2.5	6

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6.2.3 Remove Joint Rubber: Remove the Rubber with tweezers and open the white anti-dust cover to reveal the 200 Series / 500 Series / 800 Series Joint Screws.

6.2.4 Reverse the previous steps to install the dust cover and Rubber.
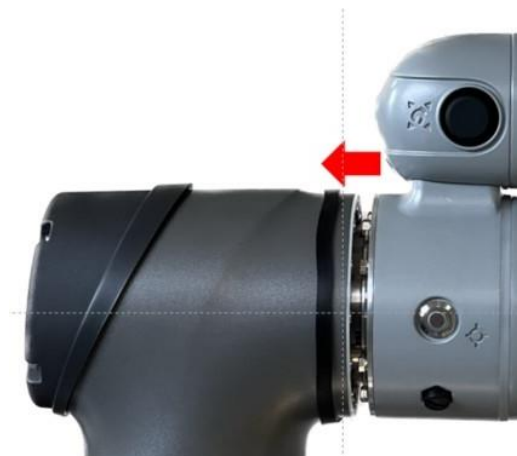
6.2.5 Removal of A01 Series Joint rubber: Use a flathead screwdriver to pry open the Rubber upward, revealing the screws for the A01 Series Joint. Reverse the above steps to reinstall the Rubber.

Remove Rubber　　　　　Disassembly Screw

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6.3 Disassembly and assembly Joint cable

6.3.1 A01 Series Joint

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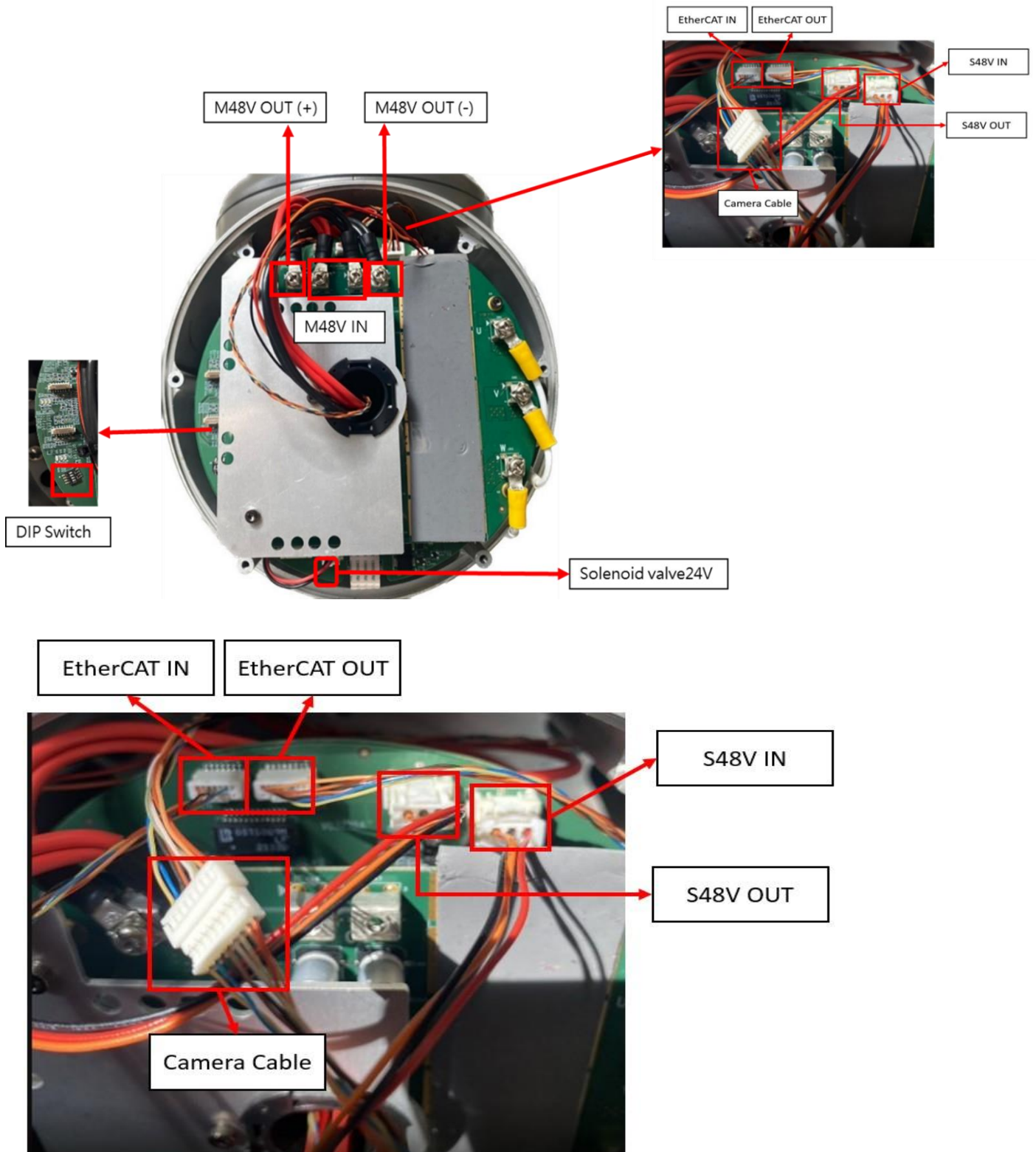
6.3.2 800 Series Joint

800 Series Joint

6.3.3 500 Series Joint

500 Series Joint

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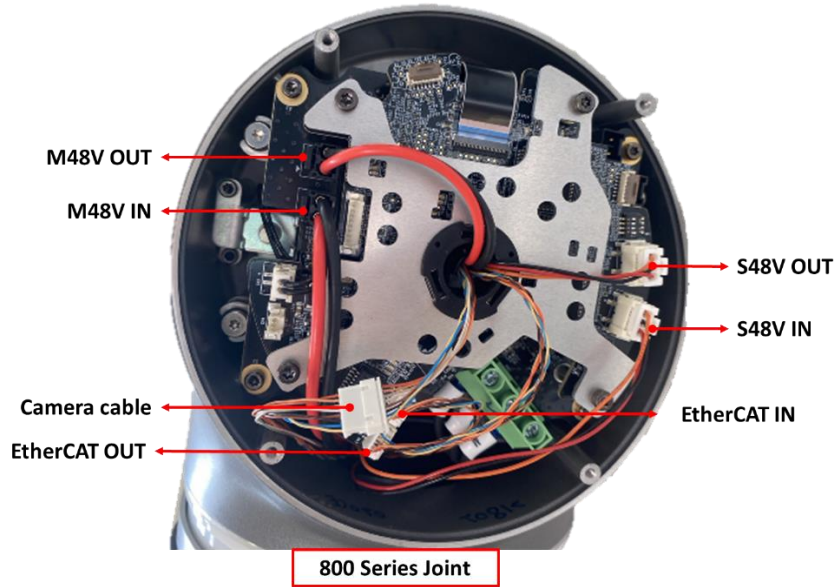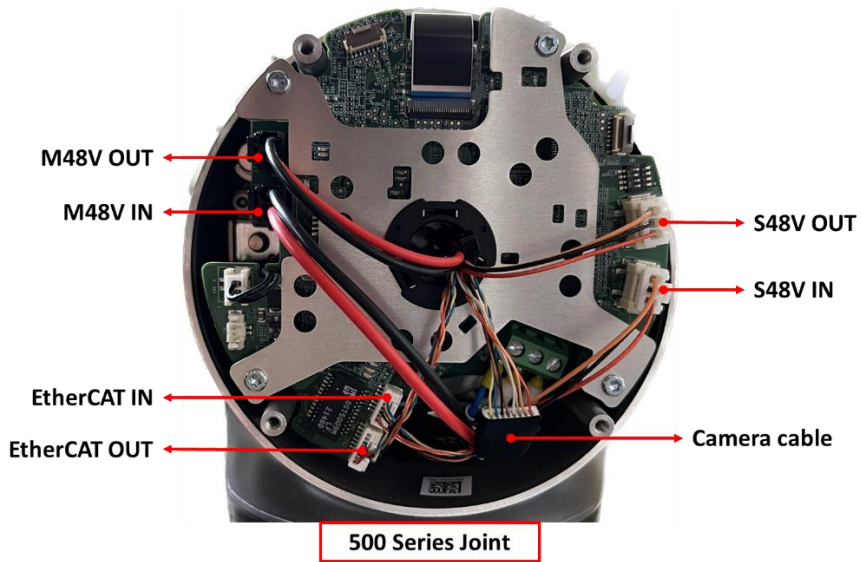
6.3.4 200L Series Joint
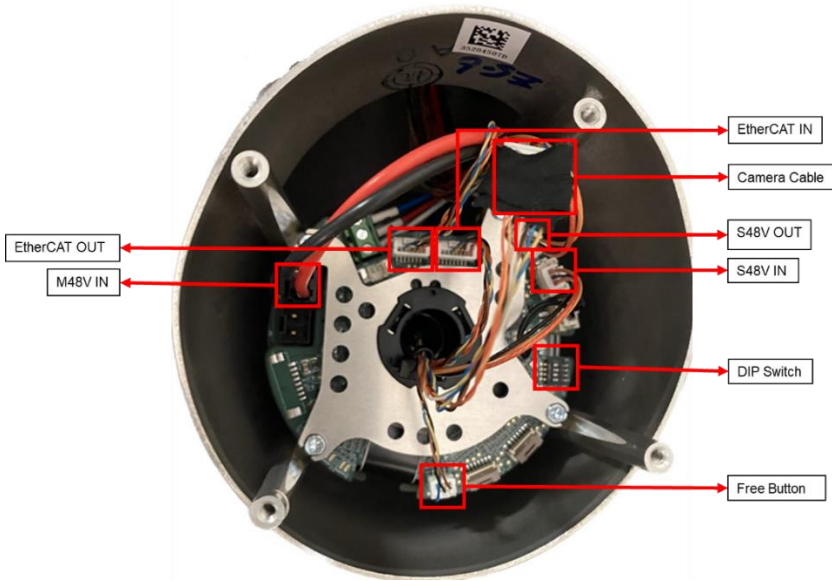
6.4 Camera Cable location

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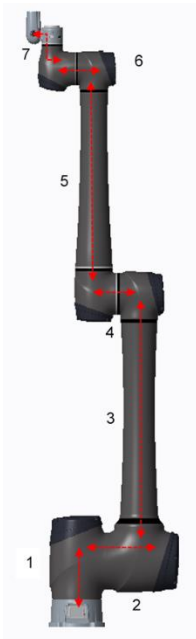
6.5 Disassembly and Assembly Joint screw

> **CAUTION:** Before remove Joint screws, ensure the Joint cables and connectors are disconnected; failure to disconnect the cable may result in damage to the Joint cable or components due to pulling or interference when removing the Joint.

6.5.1 Before remove Joint screws, remove Joint Cover and Joint Rubber.
6.5.2 Using open end wrench to loosen the screw for Joint connecting screws

Front View **A01 Series**

Side View
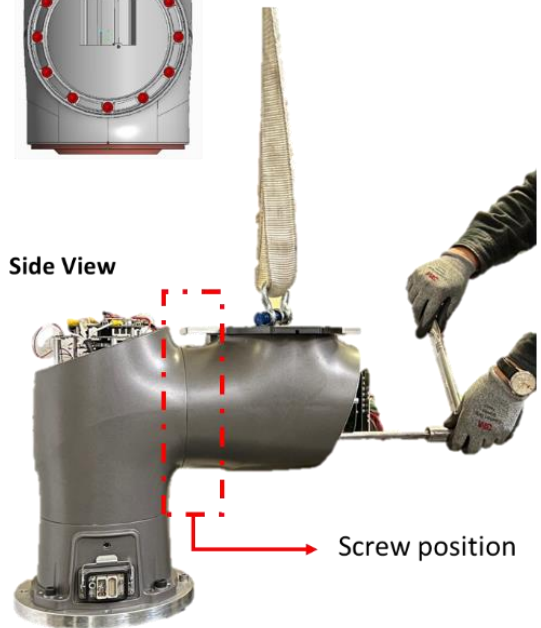
Screw position

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Torque specifications for Joint screws				
Joint Type	Screw Type	Torque Value (Kgf.cm)	Torque Value(Nm)	Total Screws
200L series	M3L14 HEX HEAD CAP	20	2.0	8
500 series	M5L20 HEX HEAD CAP	92	9.0	8
800 series	M6L20 HEX HEAD CAP	150	15	10
A01 series	M8L18 HEX HEAD CAP	180/370	18/37	10

6.5.3 When assembling the joint, to ensure the correct installation orientation, it is necessary to interlock the key and slot between the joints (refer to Figure 1 & Figure 2) (refer to Figure 3). Operators can visually align the holes or insert a Ø1.9mm pin into the hole to verify proper installation (refer to Figure 4). If the hole of two joints are not in the same direction, or if misalignment prevents the insertion of the locating pin, do not proceed with further assembly.
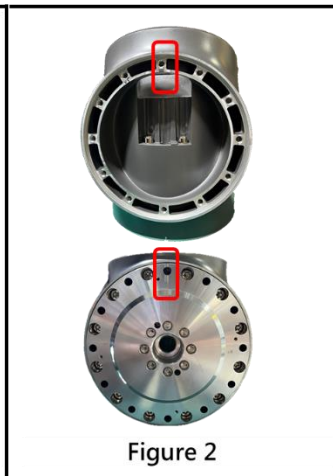
Figure 1	Figure 2	Figure 3	Figure 4

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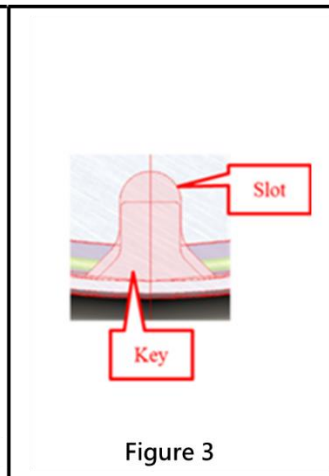
6.6 Disassembly and Assembly of Base and Robot Cable

6.6.1 Before removing the Base cover, loosen the corresponding screws and disconnect the wiring between the Robot cable and Joint 1.
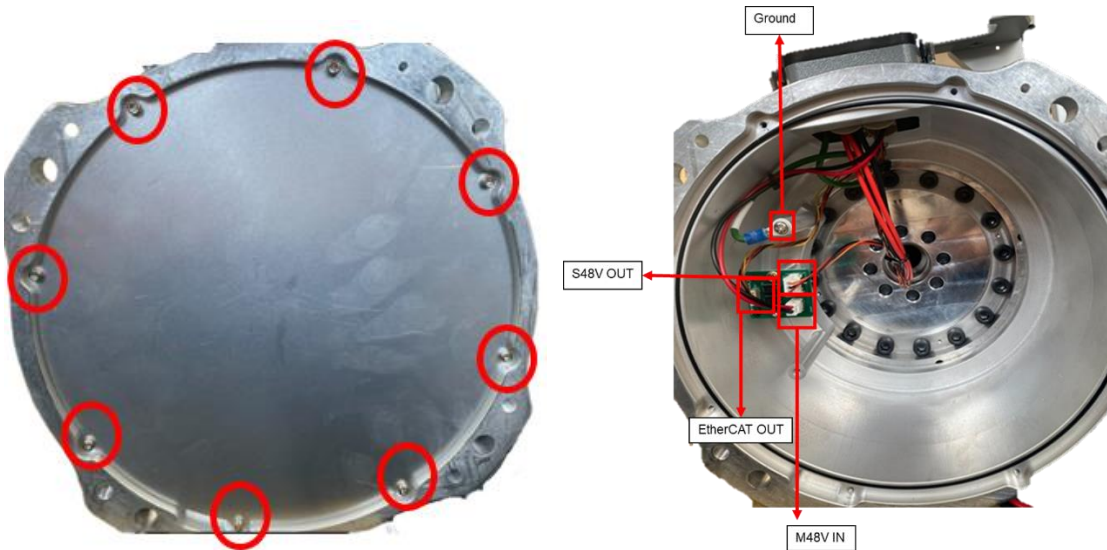
6.6.2 Remove the connector screws.
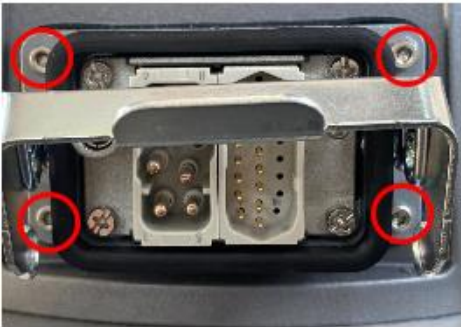
6.6.3 When assembling the Base and Robot cable, please follow the reverse steps of the previous procedure.

6.7 Disassembly and assembly A01 Series Joint – Joint 1

6.7.1 Before disassembling Joint 1, disassemble Joint 2 to the End Module.

6.7.2 Rotate Joint 1 to the home position and ensure that all joint screws are visible.

Not located at the home position.   located at the home position.
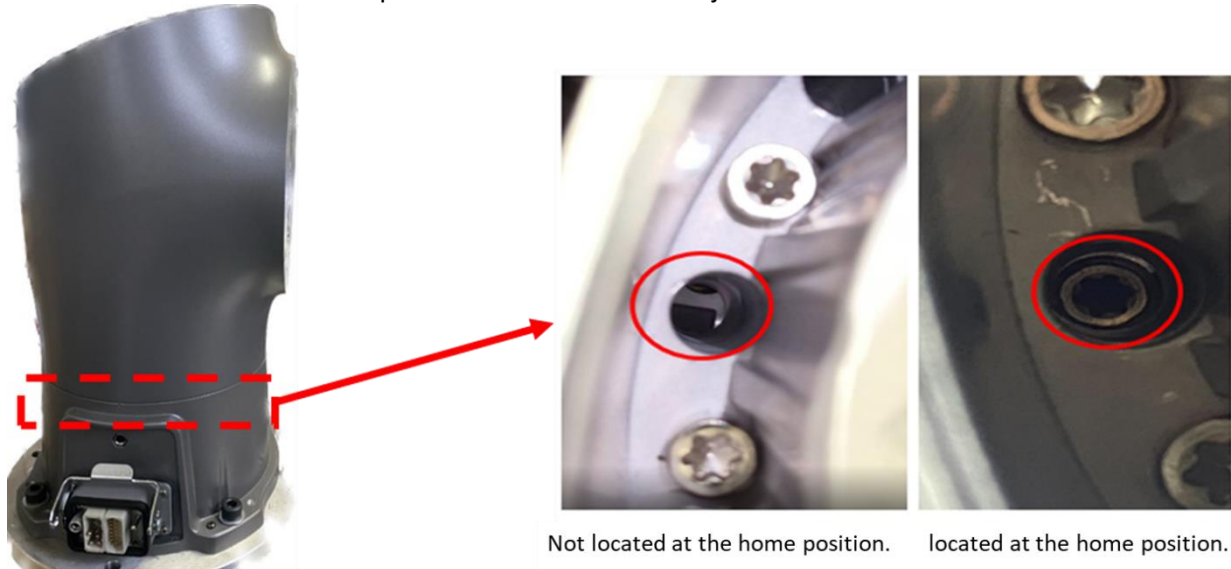
6.7.3 Remove the Joint Cover of Joint 1.

6.7.4 Remove the Joint Cable of Joint 1.

6.7.5 Install the lifting jig, secure the lifting rope to the auxiliary tool, and adjust the lifting rope slightly tight to prevent the Joint from tilting in other directions after the Joint connection screws are removed.

6.7.6 Remove the connection screws between Joint 1 and the Base, and take off Joint 1.

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6.7.7 When assembling Joint 1, align the Key and Slot of the A01 Series Joint in the figure below and follow the previous steps in reverse. 。

Caution: When assembling the A01 series joints, make sure that the A01 series joint key is securely attached to the slot to prevent abnormal operation of the arm controller or unexpected errors.

A01 Series Key Slot

A01 Series Joint Screw Side

A01 Series Flange Slot

A01 Series Joint Flange Side

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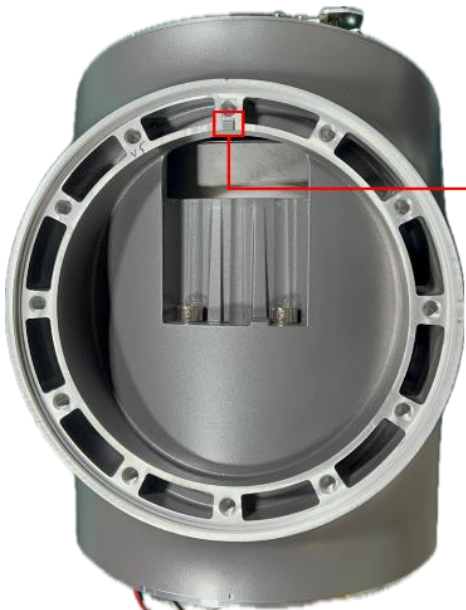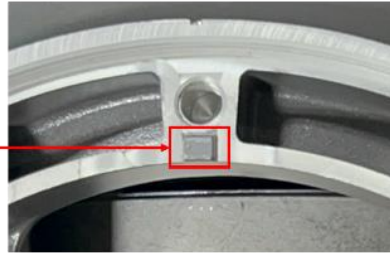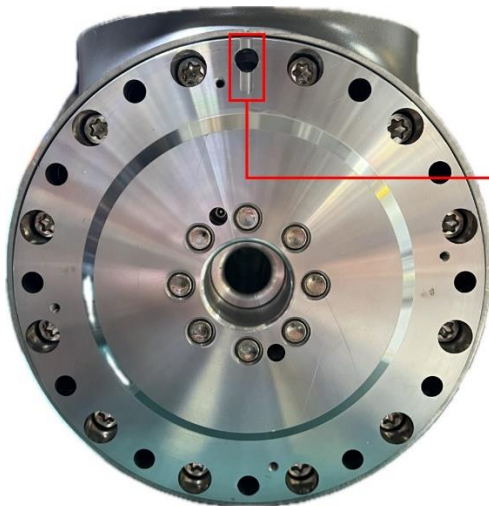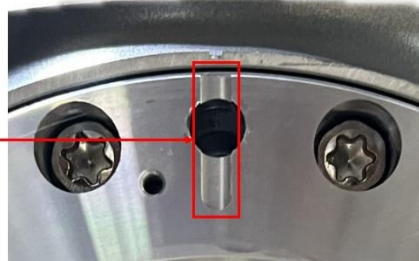
6.8 Disassembly and assembly A01 Series Joint – Joint 2

6.8.1 Before disassembling Joint 2, disassemble Upper arm to the End Module.

6.8.2 Rotate Joint 2 to the home position and ensure that all joint screws are visible.
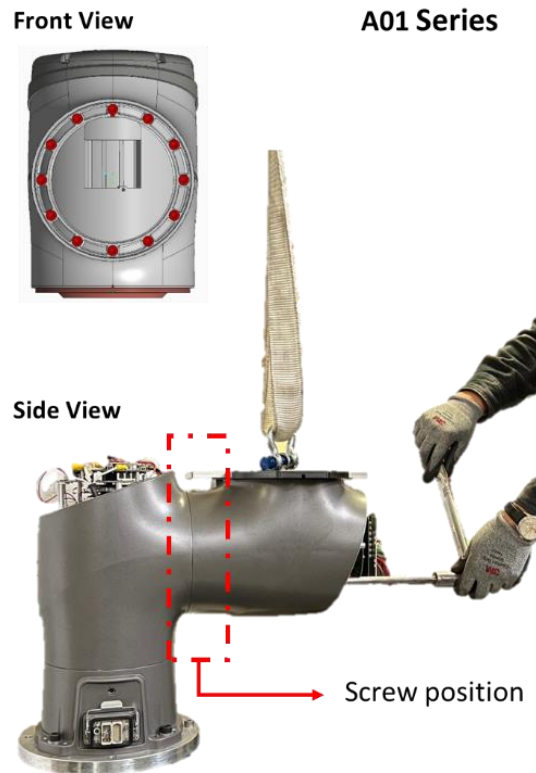
6.8.1 Remove the Joint Cover of Joint 2.
6.8.2 Remove the Joint cable of Joint 2.

6.8.3 Install the jig, secure the lifting rope to the auxiliary tool, and adjust the lifting rope slightly tight to prevent the Joint from tilting in other directions after the Joint connection screws are removed.
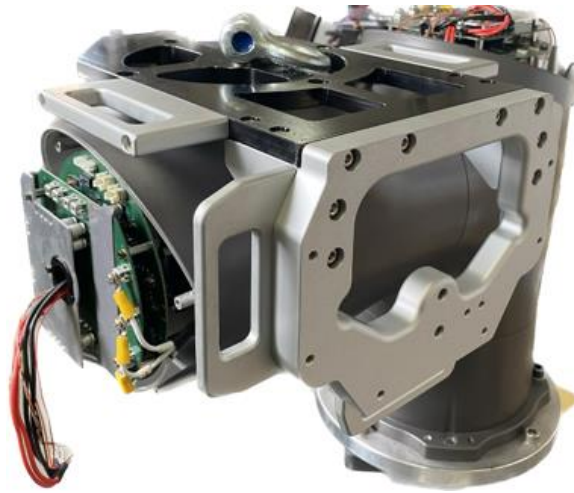
6.8.1 Remove the connecting screws between Joint 2 and Joint 1, and take off Joint.

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6.8.2 When assembling Joint 2, align the Key and Slot of the A01 Series Joint in the figure below and follow the previous steps in reverse. 。

⚠️ **Caution:** When assembling the A01 series joints, make sure that the A01 series joint key is securely attached to the slot to prevent abnormal operation of the arm controller or unexpected errors

A01 Series Key Slot

A01 Series Joint Screw Side

A01 Series Flange Slot

A01 Series Joint Flange Side

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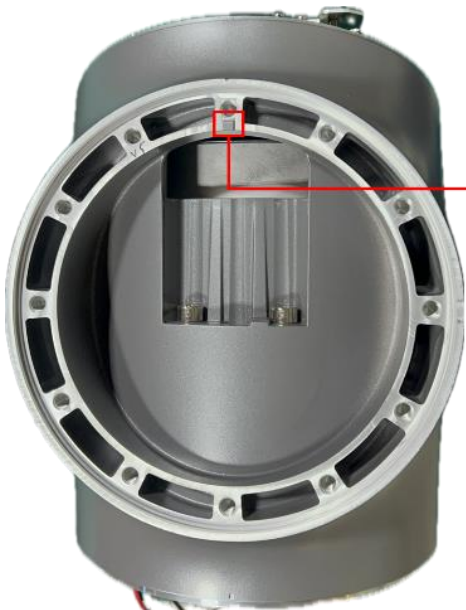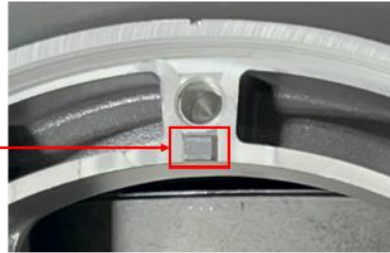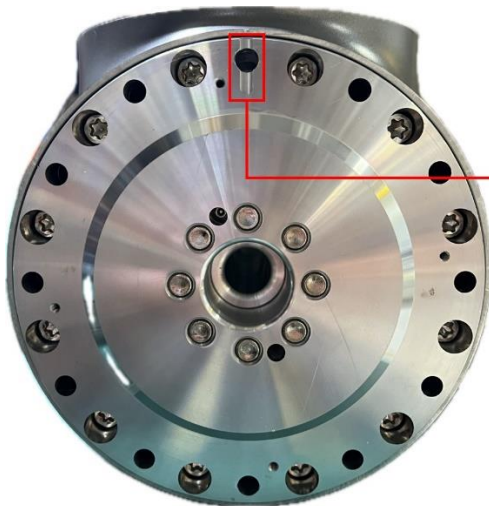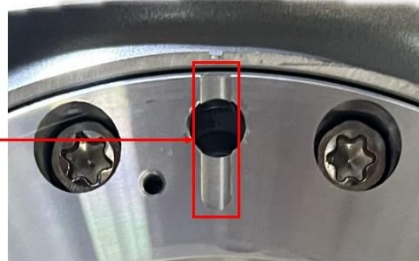
6.9 Disassembly and assembly 800 Series Joint

6.9.1 Remove the Joint cover and Joint rubber.

6.9.2 Remove the Joint cable from the Joint.

6.9.3 Remove the screws connecting the Joint to other Joints or the Arm, then detach the Joint.

6.9.4 During assembly, follow the reverse steps of the previously mentioned procedure.

6.10 Disassembly and assembly 500 Series Joint

6.10.1 Remove the Joint cover and Joint rubber.

6.10.2 Remove the Joint cable from the Joint.

6.10.3 Remove the screws connecting the Joint to other Joints or the Arm, then detach the Joint.

6.10.4 During assembly, follow the reverse steps of the previously mentioned procedure.

6.11 Disassembly and assembly 200L Series Joint

6.11.1 Remove the Joint cover and Joint rubber.

6.11.2 Remove the Joint cable from the Joint.

6.11.3 Remove the screws connecting the Joint to other Joints or the Arm, then detach the Joint.

6.11.4 During assembly, follow the reverse steps of the previously mentioned procedure.

6.12 Disassembly and assembly Upper arm

6.12.1 Remove Joint cover and Joint rubber which in Joint 2 & Joint 3

6.12.2 Remove Joint cable which in Joint 2 & Joint 3

6.12.3 Remove the screws connecting the Upper arm to Joint 2 and Joint 3, then detach the Upper arm.

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6.12.4 (Please refer Arm figure below) After removing the Upper arm, use needle-nose pliers to compress the bracket at location A, then extract the bracket from the groove. Next, remove the wiring and plastic bushing at location B.

Arm Figure
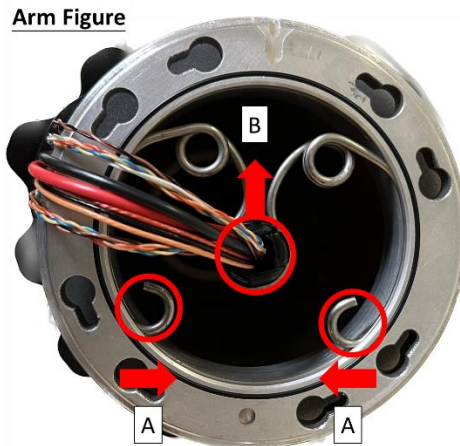
6.12.5 During Upper assembly, follow the reverse steps of the previously mentioned procedure.

6.12.6 When replacing the MII cable, camera cable, and S48V cable from Joint 2 to Joint 3, there is no need to disassemble the Arm tube. You can directly insert the new cables from Joint 3 and pull them out from Joint 2. For the old cables, trim the connectors at both ends and pull them out.

6.12.7 When inserting the new cables, apart from the power cable, the other cables (MII cable, camera cable, S48V cable) do not need to be tied inside the metal ring. However, it is necessary to use acetic acid cloth to secure the new cables.

6.13 Disassembly and assembly Lower arm

6.13.1 Remove Joint cover and Joint rubber which in Joint 4 & Joint 5

6.13.2 Remove Joint cable which in Joint 4 & Joint 5

6.13.3 Remove the screws connecting the Lower arm to Joint 2 and Joint 3, then detach the Upper arm.

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6.13.4 (Please refer Arm figure below) After removing the Upper arm, use needle-nose pliers to compress the bracket at location A, then extract the bracket from the groove. Next, remove the wiring and plastic bushing at location B.

Arm Figure
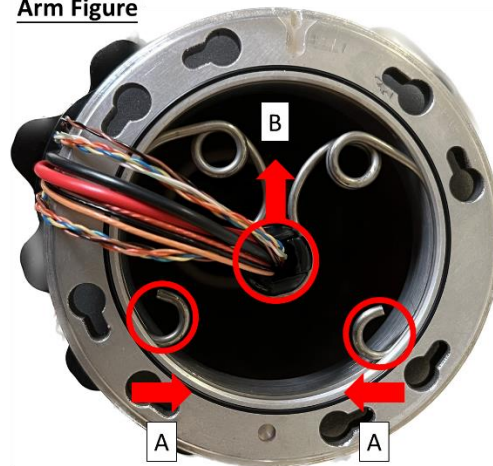
6.13.5 During Lower arm assembly, follow the reverse steps of the previously mentioned procedure.

6.13.6 When replacing the MII cable, camera cable, and S48V cable from Joint 4 to Joint 5, there is no need to disassemble the Arm tube. You can directly insert the new cables from Joint 5 and pull them out from Joint 4. For the old cables, trim the connectors at both ends and pull them out.

6.13.7 When inserting the new cables, apart from the power cable, the other cables (MII cable, camera cable, S48V cable) do not need to be tied inside the metal ring. However, it is necessary to use acetic acid cloth to secure the new cables.

6.14 Disassembly and assembly End module

6.14.1 Remove Joint cover and Joint rubber which in Joint 6

6.14.2 Remove Joint cable which in Joint 6.

6.14.3 Remove the connecting screws between Joint 6 and the End module, then detach the End module.

6.14.4 During assembly, follow the reverse steps of the previously mentioned procedure.

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6.15 Disassembly and assembly Light module

6.15.1 Refer to the picture below to remove the four screws securing the camera light source module.

6.15.1 Unplug the power cable of the light source module and remove the light source module, being careful not to let the O-ring fall off.

6.15.2 During the assembly of the End module, please follow the reverse steps of the previously mentioned procedure.

6.16 Disassembly and assembly Camera module

6.16.1 Loosen the three M3L10 screws on the camera module, separate the camera module casing from the End module. The torque during assembly is 10 kgf·cm.
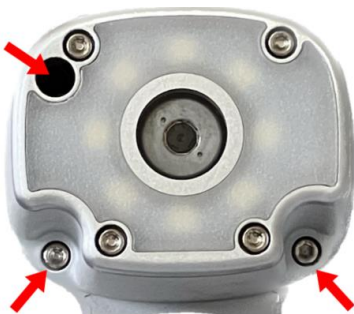
6.16.2 Disconnect the cables as shown in the below.
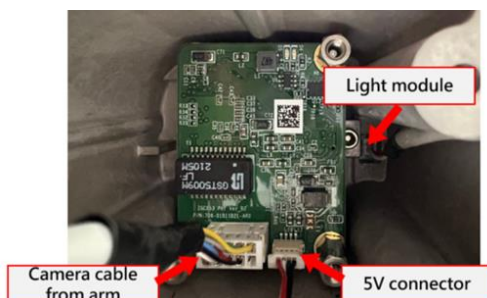
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6.16.1 After removing the camera module, take off the three M3L6 screws securing the TRI camera. The torque during assembly is 10 kgf·cm

6.16.1 After removing the TRI camera unit (refer to the below picture), replace it directly with a new TRI camera. Do not perform any disassembly or modifications on the components of the unit.
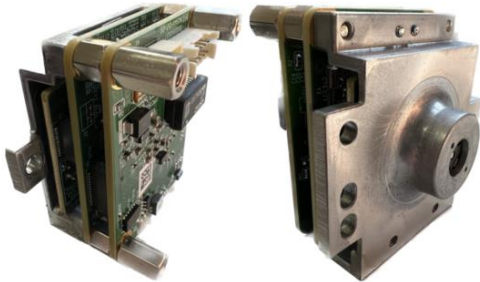
6.16.2 When assembling the camera, please follow the reverse steps of the previously mentioned procedure.

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6.17 DIP Switch Setting

6.17.1 After replacing or rearranging Joints, use pliers to move the Joint DIP switch to the corresponding position according to the following specifications:
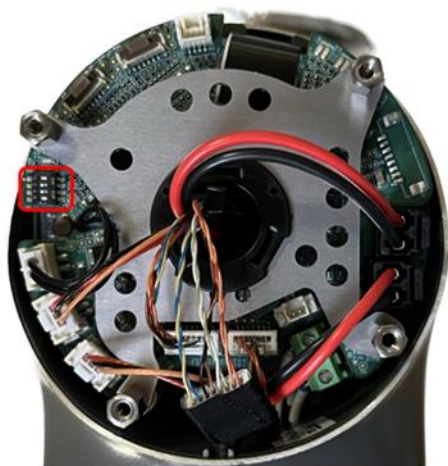
200L Series Joint
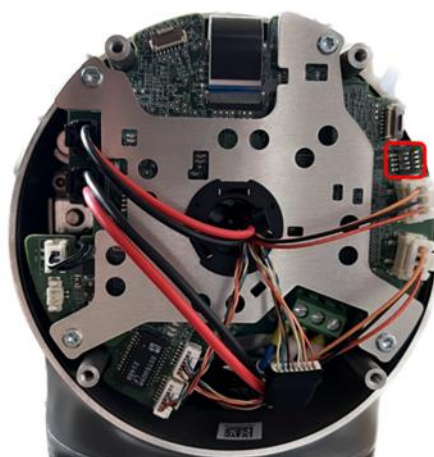
500 Series Joint
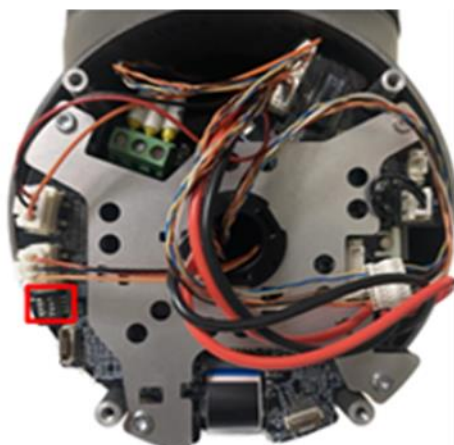
800 Series Joint
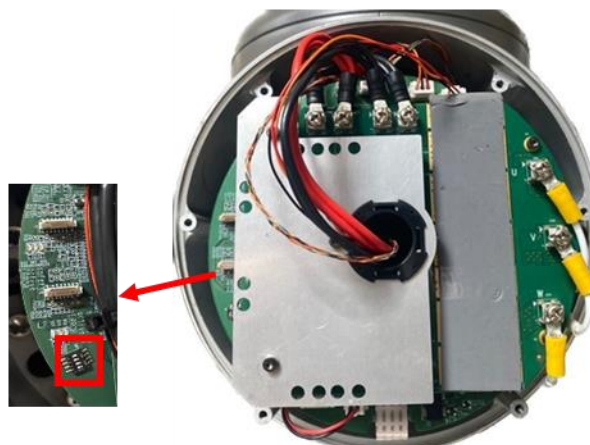
A01 Series Joint

J1		ON					J4		ON			
	H	▮						H	▮			▮
	L		▮	▮	▮			L		▮	▮	
		1	2	3	4				1	2	3	4

J2		ON					J5		ON			
	H	▮						H	▮			▮
	L		▮	▮	▮			L		▮	▮	
		1	2	3	4				1	2	3	4

J3		ON					J6		ON			
	H			▮				H		▮		▮
	L	▮	▮		▮			L	▮		▮	
		1	2	3	4				1	2	3	4

CAUTION: Failure to set the DIP switch on the Joint to the specified position may trigger Error Code 0x0000004E or other unexpected errors.

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6.18 Software Update

6.18.1 Notes：

6.18.1.1 Follow the table below to update perform ReinstallrobotID, ESI and Firmware(FW) updates after replacing patriot power board, end module and joints：

	ReinstallrobotID	ESI	Firmware(FW)
Patriot power board	●	●	●
End module	●	●	●
Joints	○	●	●
●Required ○Not Required			

6.18.1.2 The Robot ID is stored in both patriot power board and end module PCBA. System may trigger error code 0x3C or others if it detects a discrepancy between the robot IDs of those two parts.

6.18.1.3 Replacing the above-mentioned components without updateing the ESI and firmware as required will not trigger errors immediately. However, to prevent potential unforeseen errors caused by inconsistencies in ESI and firmware versions between components or mismatches with the current TM Flow version, it is essential to perform updates after replacing components. This ensures that the ESI and firmware of all components align with the current TM Flow version.

6.18.1.4 Two update methods are provided below. Refer to the table for appropriate applications:

	TM Flow	Manually updating
Patrioit power board (new)	●	●
Patrioit power board (used)	○	●
End module (new)	●	●
End module (used)	○	●
Joint (new)	●	●
Joint (used)	●	●
●Applicable ○Not Applicable Both methods require a maintenance dongle.		

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6.18.1.5 Restoring the calibration data:

(a.)Replacing patriot power board: User may see the following screen upon startup after replacing a new patrioit power board. Click 'OK' and enter the default password (ddefault 00000000), the control box will reboot and synchronize the calibration data to the patriot power board.
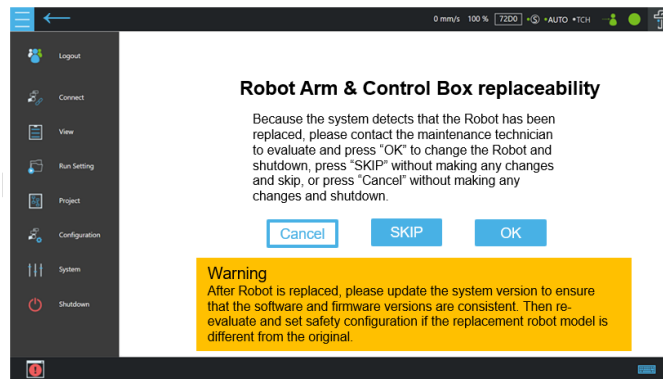
(b.)Replacing end module: After replacing and new end module, user must enter the maintenance mode (firstly click SKIP on the page 'Robot Arm & Control Box replaceability') and type in the password (default 00000000) and log in. Then, click calibration data 'Set' to upload the calibration data to the end module PCBA.

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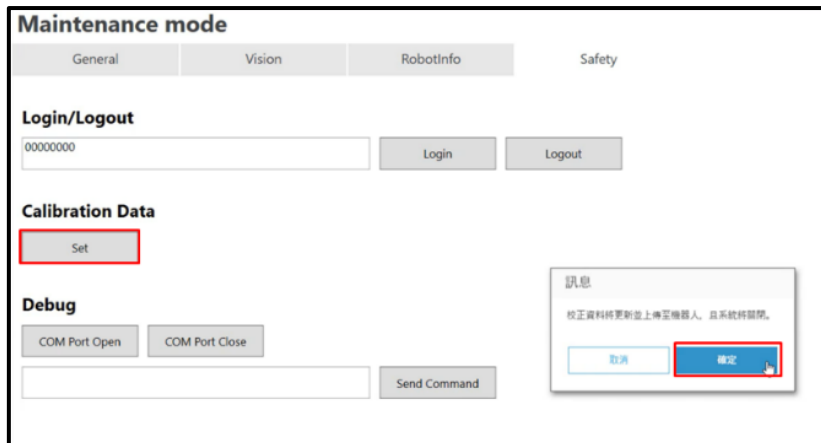
6.18.2 Updating Robot ID, ESI and Firmware via TM Flow:

6.18.2.1 When replacing robot joints, it is only necessary to perform TM Flow update after powering on. There is no need to update the Robot ID.

6.18.2.2 After replacing brand-new end module or patriot power board, since these components do not initially have a Robot ID written into them, the system will display the following error screen (Error code 0x3C) when it detects that the Robot ID in these components does not match the robot model.
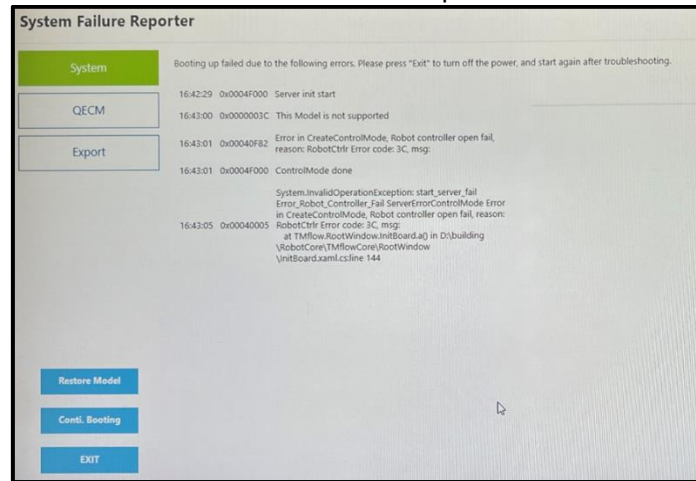
6.18.2.3 Click Restore model. The system will write the corresponding Robot ID into the blank end module and patriot power board base on the robot model last time recorded by the control box. Once the written process is done, the control box will shut down.
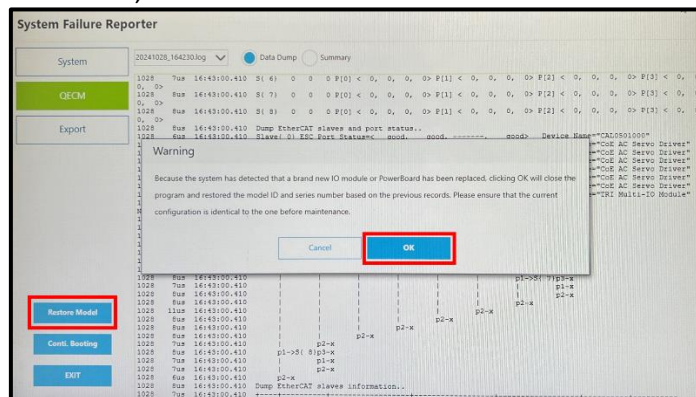
6.18.2.4 After restarting, follow the 'System Update'section in the software manual to update the TM Flow to the same or newer version. During the system update process, ESI and firmware will be updated automatically.

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6.18.3 Manually updating Robot ID, ESI and Firmware:

6.18.3.1 Enter Windows: While the control box is powered off, press the emergency stop button and insert the maintenance dongle to the control box. After powering on, TM Flow will display error codes due to the emergency stop cutting off the power between control box and the robot arm. Click 'Exit' at the bottom left of the screen to enter Windows.

Warning: After entering Windows, release the emergency stop button. Once released, check if the end module indicator light is blinking. If the light is not blinking, it indicates that the control box is not correctly connected to the robot arm. Do not proceed with the subsequent steps and priotirize troubleshooting the issue.

6.18.3.2 ReinstallrobotID: After replacing patriot power board or end module and entering Windows, run the file 'ReinstaillRobotID' located in the path: D:\Techman Robot\TM Flow\ModuleRelease. This step can be skipped if only joints were replaced.

- Esi
- Fw
- CheckRtxLicense
- DumpEsiInfo
- QuerySlaveInfo
- **ReinstallRobotId**
- Rtx64TRiEcatNalSlaveInfo.rtss
- UpdateEsi
- UpdateFw
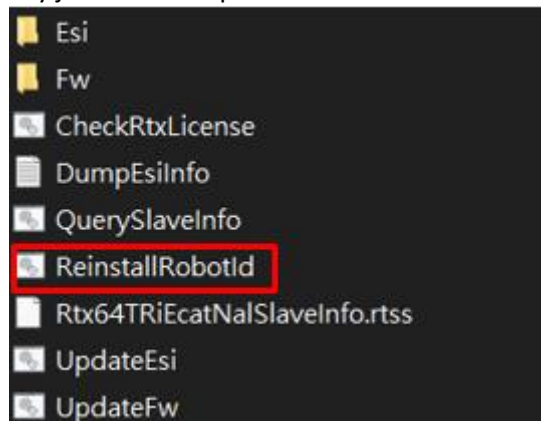
6.18.3.3 UpdateEsi: After entering Windows, run the file 'UpdateEsi' located in the path: D:\Techman Robot\TM Flow\ModuleRelease.

- Esi
- Fw
- CheckRtxLicense
- DumpEsiInfo
- QuerySlaveInfo
- ReinstallRobotId
- Rtx64TRiEcatNalSlaveInfo.rtss
- **UpdateEsi**
- UpdateFw

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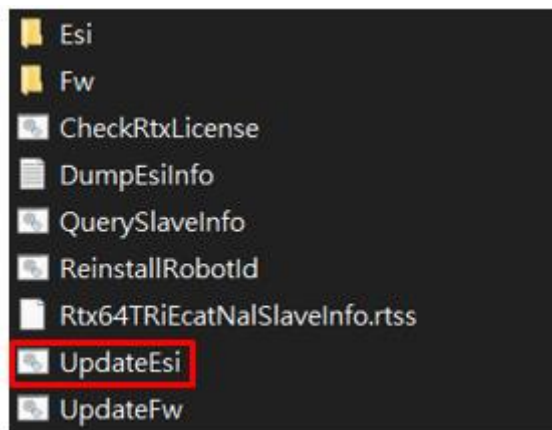
6.18.3.4 UpdateFW：After entering Windows, run the file 'UpdateFW' located in the path: D:\Techman Robot\TM Flow\ModuleRelease. Once the firmware update is complete, completely power off the control box and robot arm. It is recommended to unplug the external power cable after shutting down and then plug it back in to ensure the power if fully turned off before restarting.

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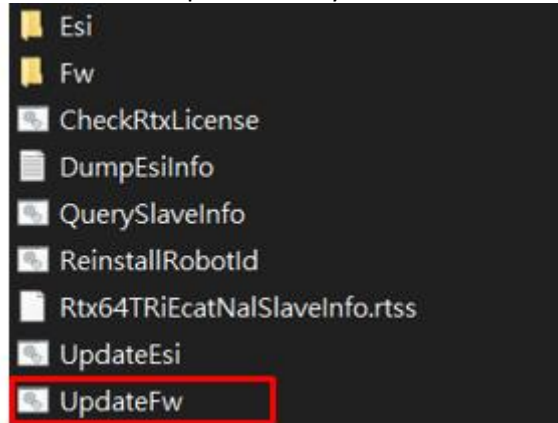
7. Control BoxDisassembly /Assembly Control Box

7.1 Quick maintenance guide

    7.1.1 To ensure operational safety, at least two persons are required to collaborate in the disassembly process.

    7.1.2 Before disassembly, place the control box on a soft surface (such as a blanket or sponge pad) for disassembly.

    7.1.3 Before disassembly, take photos to record the status and wiring configuration. These photos will serve as reference points during the reassembly process.

    7.1.4 Follow the right-hand rule when disassembling and installing screws.

    7.1.5 When installing components, use a torque wrench to tighten the parts according to the torque specifications table below:

Torque specifications for Control board		
Item	torque value(Kgf.cm)	torque value(Nm)
IPC	6	0.6
Patriot power board	6	0.6
Relay board	6	0.6
Power eater board	6	0.6
PSU cable	10	0.98
PSU Bracket	14	1.37
SSD Bracket	14	1.37

7.2 Open the Control Box Outer Casing

    7.2.1 Before opening the outer casing of the control box, ensure that the control box is completely powered off, and disconnect the external power cord and robot cable.

    7.2.2 Open the outer casing cover of the control box, loosen the four inner casing screws, and open the inner casing cover.

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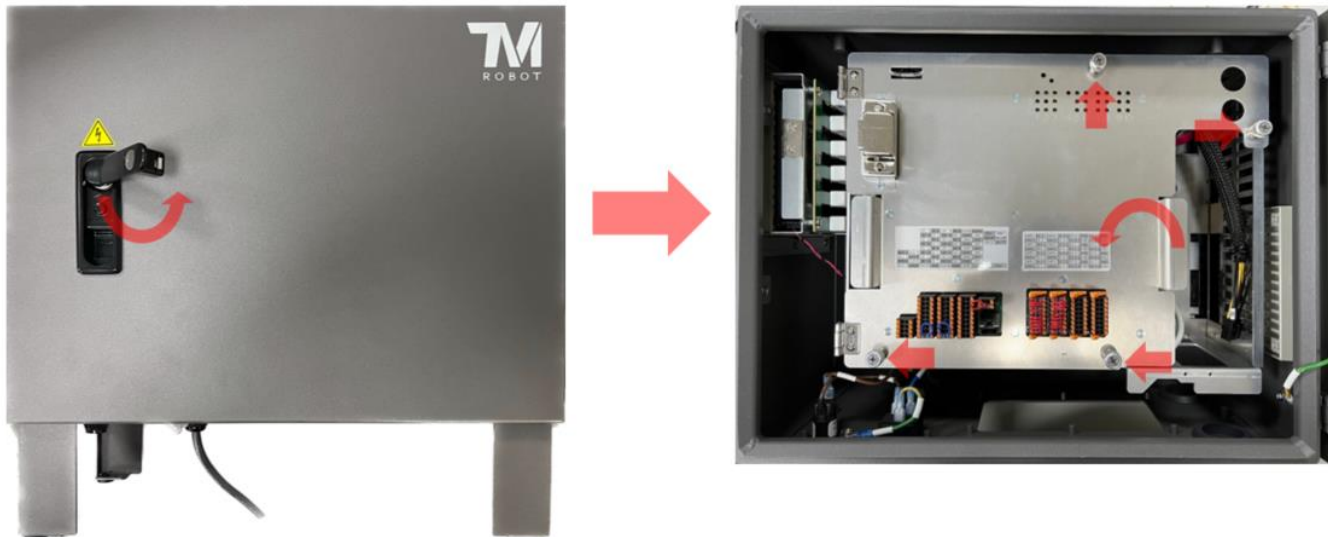
7.3 Disassembly/Assembly of IPC

    7.3.1 Refer to "Open the Control Box Outer Casing" to open the outer casing cover and inner casing cover.

    7.3.2 Refer to the diagram below to remove the connectors, and if necessary, cut cable ties.
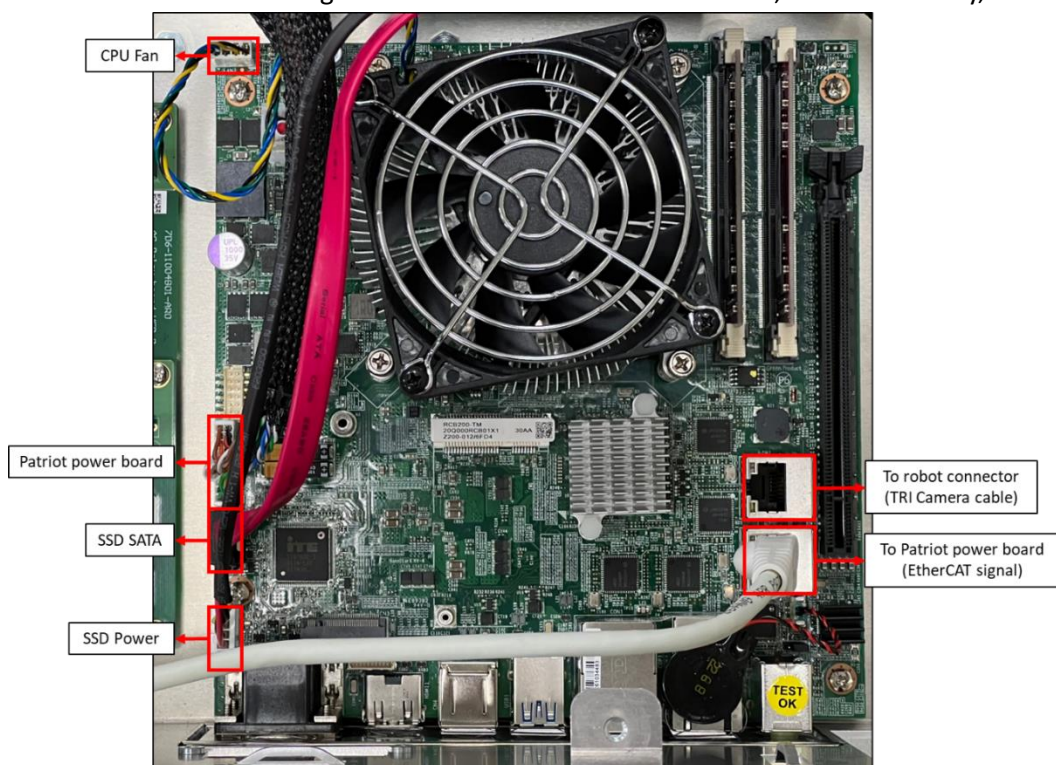
7.3.1 Loosen the four screws securing the IPC.

7.3.1 During installation, follow the reverse steps of the above procedure. If cable ties were cut, secure the wires again in the original manner.

7.4 Disassembly/Assembly of the Patriot Power Board

⚠️ **Caution:** Replacing the Patriot power board will reset the Safety settings in the TM flow, please refer to the Safety settings section in the software manual for saving and recovery.

7.4.1 Refer to "Open the Control Box Outer Casing" to open the outer casing cover and inner casing cover.

7.4.2 Refer to the diagram below to remove the connectors, and if necessary, cut cable ties:

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Remove cover
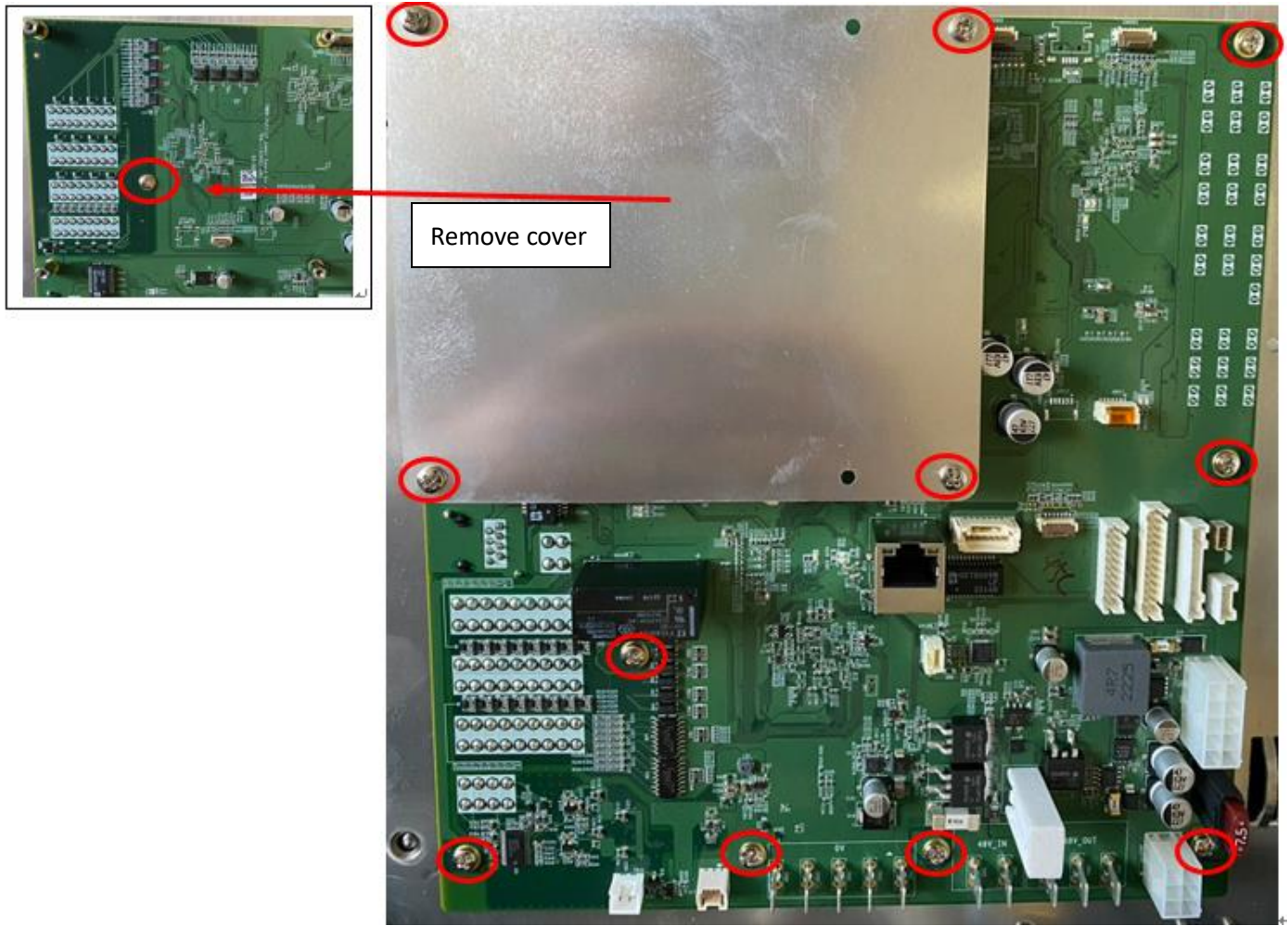
7.4.3 Loosen the 12 screws securing the Patriot Power Board.

7.4.4 During installation, follow the reverse steps of the above procedure. If cable ties were cut, secure the wires again in the original manner

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7.5 Disassembly/Assembly Relay board

7.5.1 Refer to "Open the Control Box Outer Casing" to open the outer casing cover and inner casing cover.

7.5.2 Refer to the diagram below to remove the connectors, and if necessary, cut cable ties
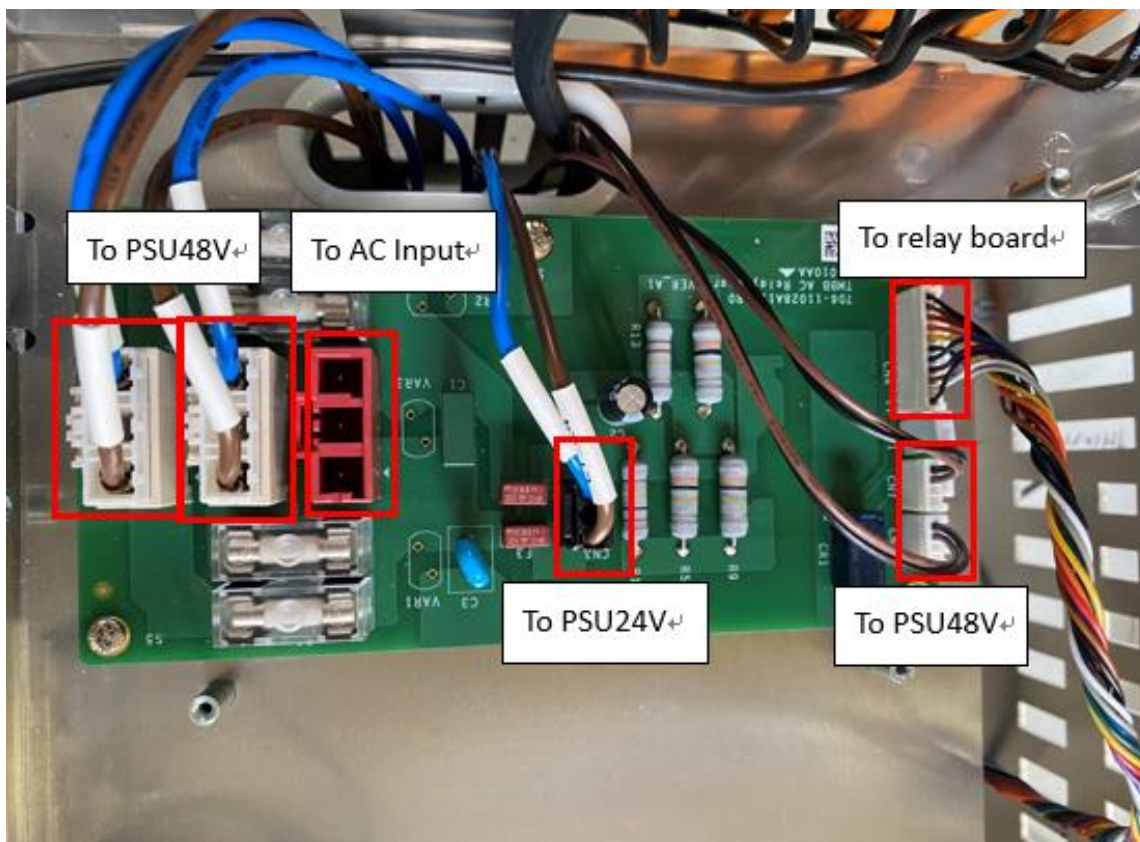
7.5.3 Loosen the 6 screws securing the Relay Board.
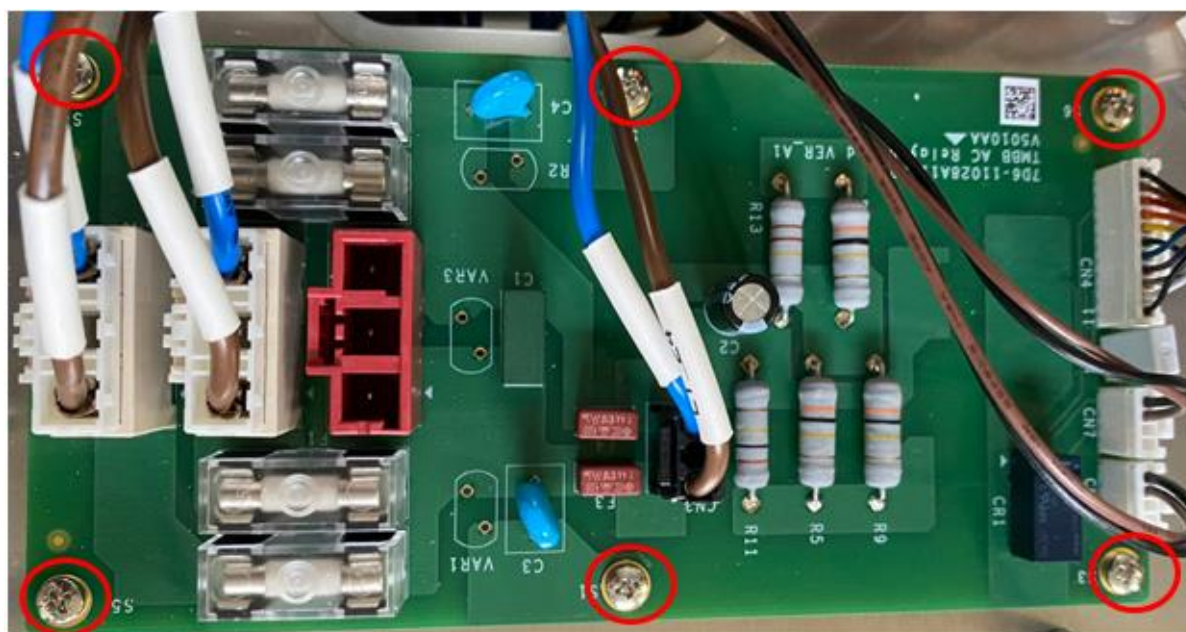
7.5.1 During installation, follow the reverse steps of the above procedure. If cable ties were cut, secure the wires again in the original manner

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7.6 Disassembly/Assembly Stick

7.6.1 Refer to "Open the Control Box Outer Casing" to open the outer casing cover and inner casing cover

7.6.2 Refer to the diagram below to remove the Stick connector, and if necessary, cut cable ties:

7.6.1 Refer to the diagram to sequentially loosen Stick securing nut A and wire securing nut B:
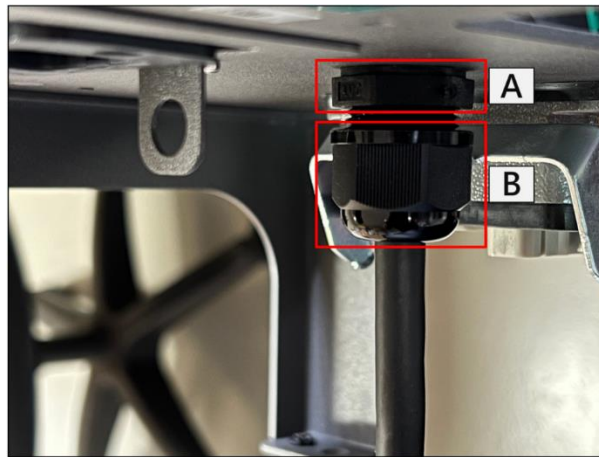
7.6.2 Refer to the diagram to gently bend the Stick connector slightly, and sequentially thread it through the Stick securing nut (Figure A) and the control box (Figure B) to remove the Stick.
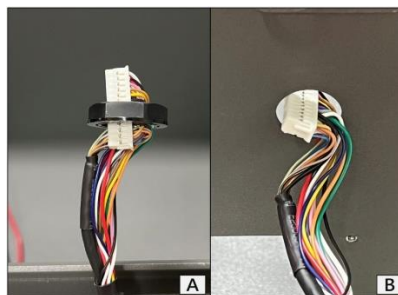
7.6.1 During installation, follow the reverse steps of the above procedure. If cable ties were cut, secure the wires again in the original manner

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7.7 Disassembly/Assembly of Robot Connector and Internal Composite Cable

7.7.1 Refer to "Open the Control Box Outer Casing" to open the outer casing cover and inner casing cover

7.7.2 Refer to "Disassembly/Assembly Patriot power board" to remove" Robot connector (Servo 48V)"

7.7.3 Refer to "Disassembly/Assembly Patriot power board" to remove" Robot connector (Motor 48V)".

7.7.4 Refer to "Disassembly/Assembly Patriot power board" to remove" Robot connector (EtherCAT).

7.7.5 Refer to "Disassembly/Assembly IPC" to remove" Robot connector (Camera).

7.7.6 Remove the grounding wire as shown in the diagram below.

7.7.7 Remove the four Robot connector screws shown in the diagram and take out the internal composite cable
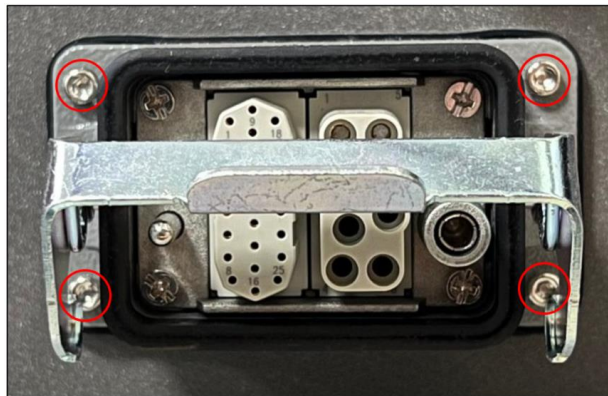
7.7.8 During installation, follow the reverse steps of the above procedure. If cable ties were cut, secure the wires again in the original manner

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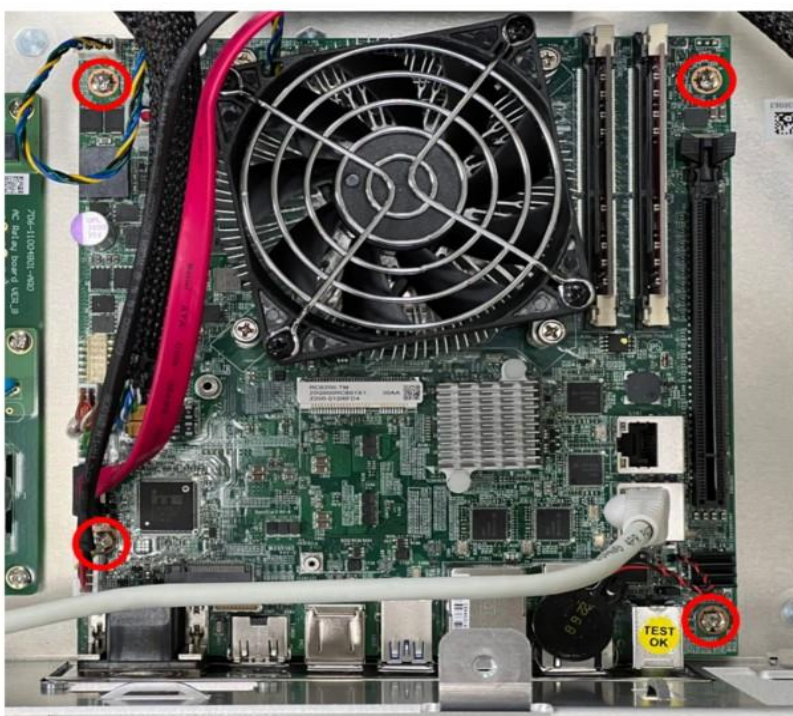
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7.8 Disassembly/Assembly of Inner Casing

7.8.1 Refer to "Open the Control Box Outer Casing" to open the outer casing cover and inner casing cover

7.8.2 Refer to "Disassembly/Assembly of Robot Connector and Internal Composite Cable" to remove the Robot connector and internal composite cable.

7.8.3 Refer to "Disassembly/Assembly of the Patriot Power Board" to remove the "To Power eater board B" connector.

7.8.4 Refer to "Disassembly/Assembly of the Patriot Power Board" to remove the "To Power eater board B" connector.

7.8.5 Refer to "Disassembly/Assembly of the Patriot Power Board" to remove the "To Control box fan" connector.

7.8.6 Refer to "Disassembly/Assembly of the Relay Board" to remove the "From external power (AC IN)" connector.

7.8.7 Refer to the diagram below to remove the 7 inner casing securing nuts and take out the inner casing.

7.8.8 During installation, follow the reverse steps of the above procedure. If cable ties were cut, secure the wires again in the original manner
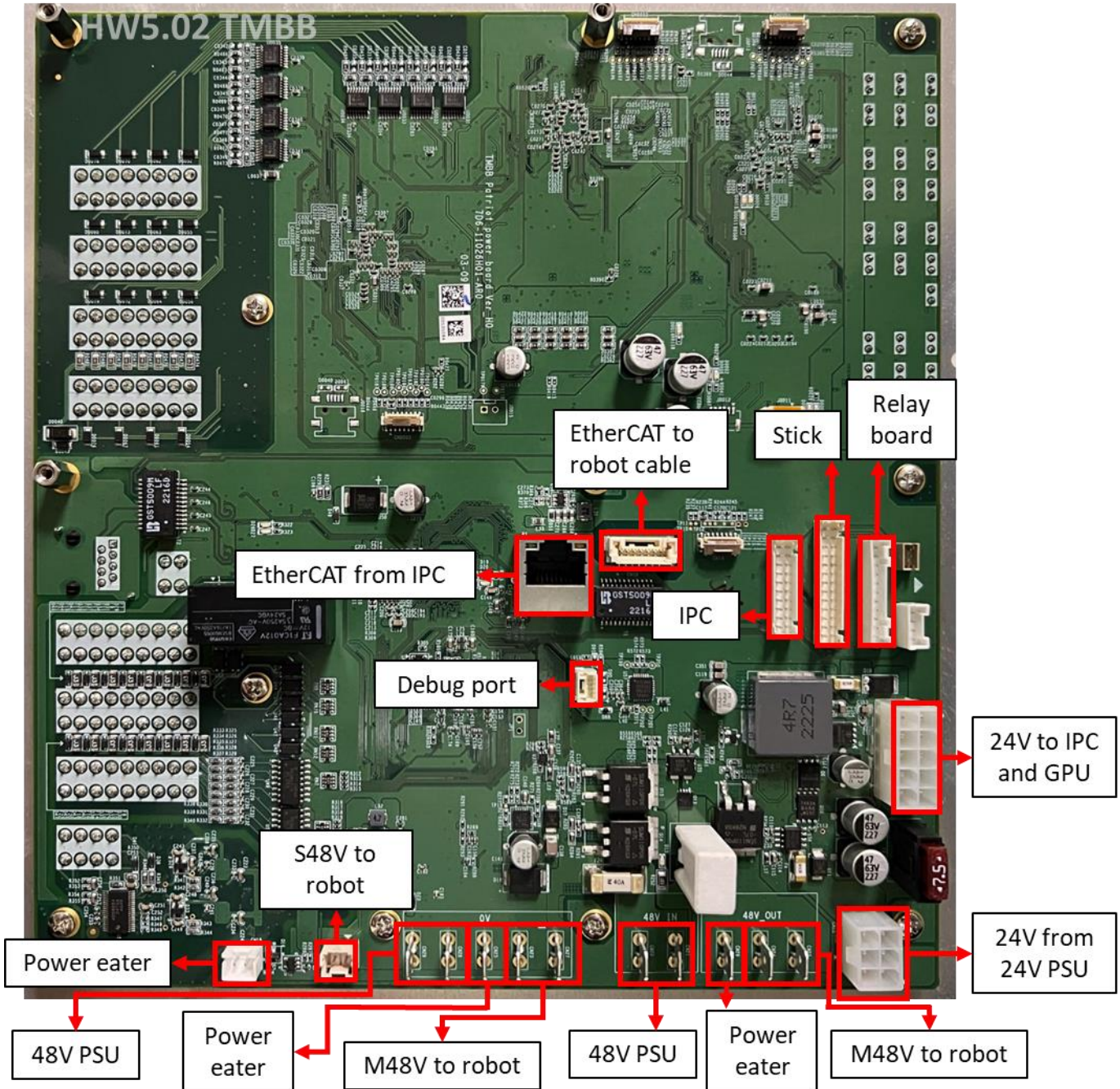
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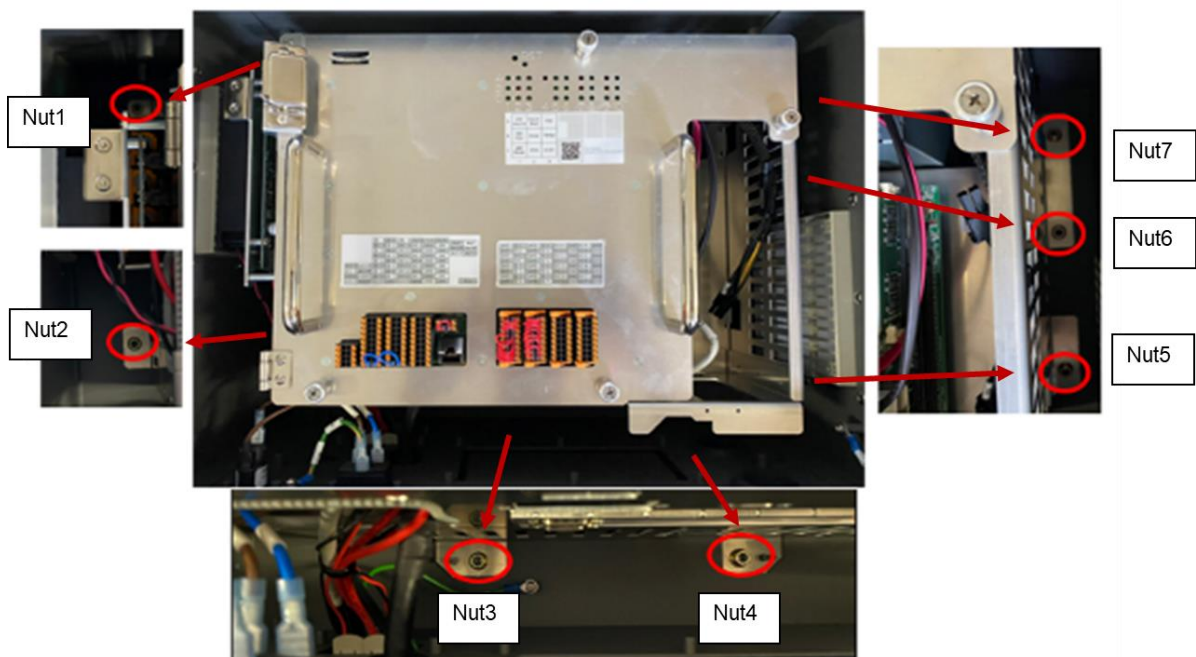
7.9 Disassembly/Assembly Power eater board

7.9.1 Refer to "Disassembly/Assembly of Inner Casing" to remove the inner casing

7.9.2 Refer to the diagram below to remove the connectors "To Patriot power board A" and "To Patriot power board B". After removing the four securing screws, take out the Power Eater Board.

7.9.3 During installation, follow the reverse steps of the above procedure. If cable ties were cut, secure the wires again in the original manner.

7.10 Disassembly/Assembly of 48V PSU (Two 48V PSU inside the TM25S control box)

7.10.1 Refer to "Disassembly/Assembly of Inner Casing" to remove the inner casing.

7.10.2 Refer to the diagram below to disconnect the wiring.

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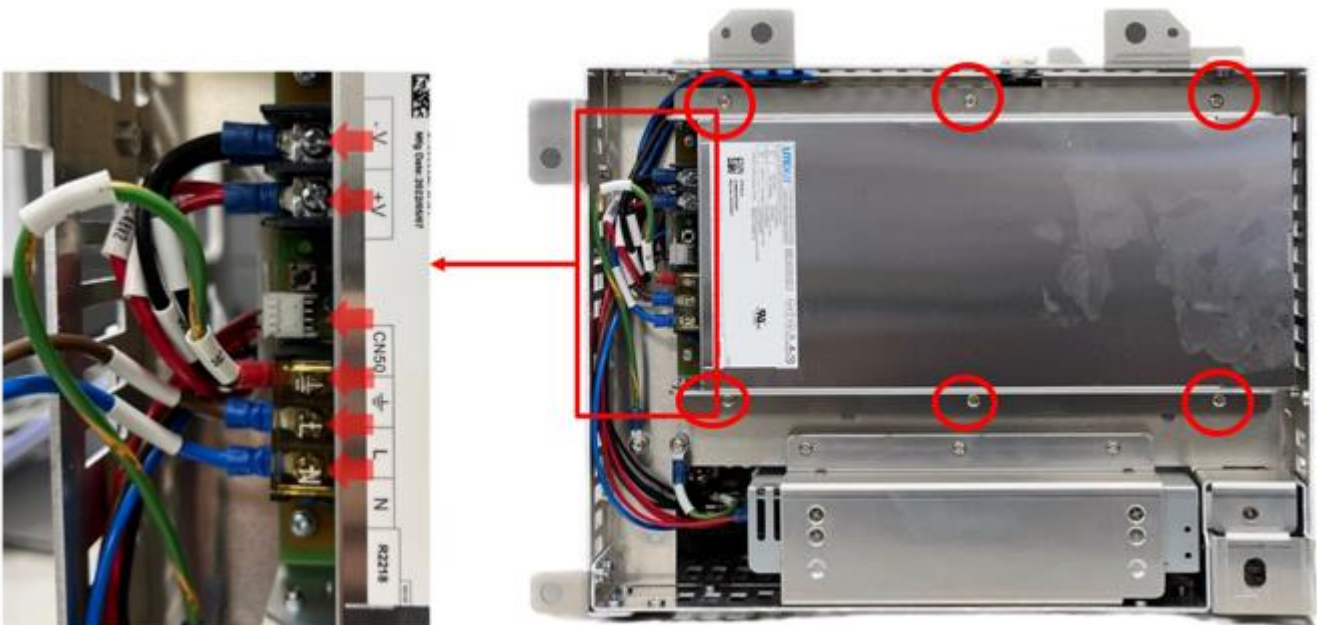
7.10.1 Refer to the diagram below to remove the six securing screws and take out the 48V PSU with the bracket.
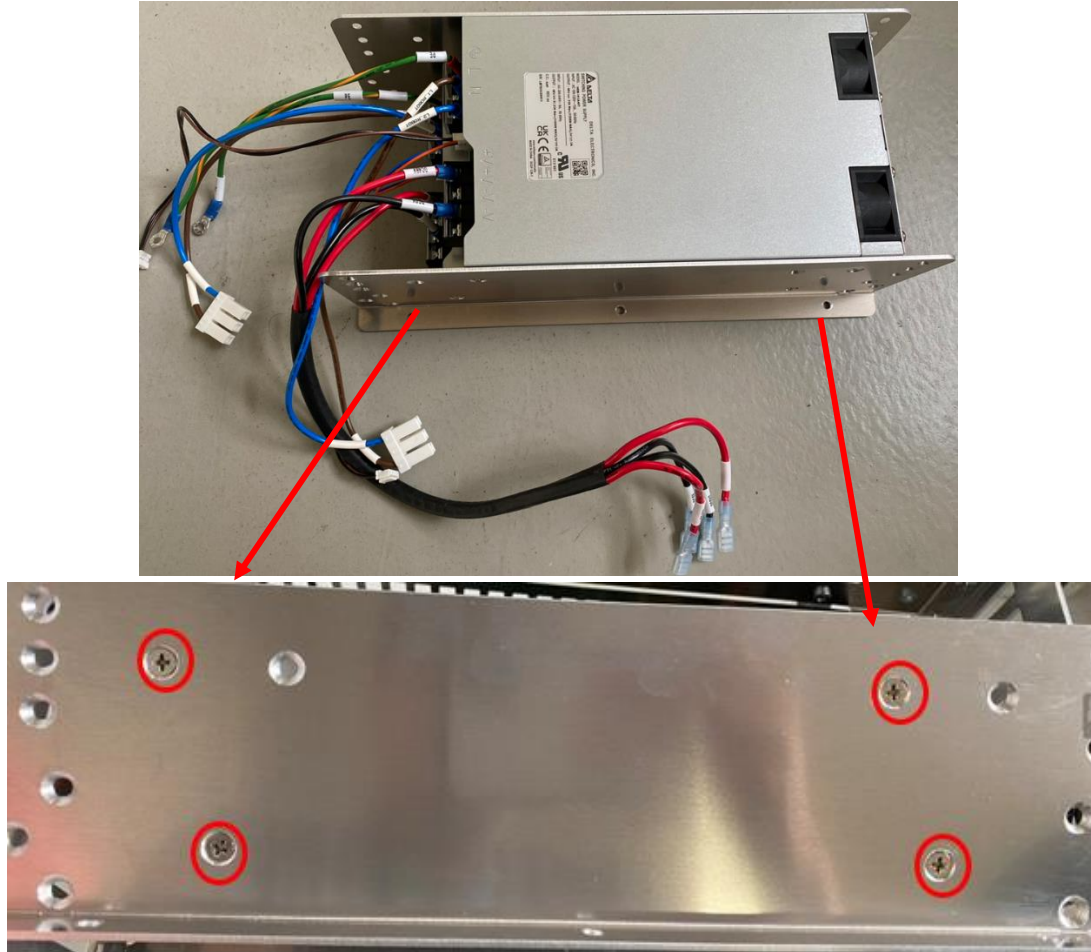
7.10.2 Refer to the diagram above to remove the four securing screws and take out the 48V PSU with the bracket.

7.10.3 During installation, reverse the above steps. If cable ties were cut, reattach the cables using the original securing method.

7.11 Disassembly/Assembly 24V PSU

7.11.1 Refer to "Disassembly/Assembly of Inner Casing" to remove the inner casing.

7.11.2 Refer to the diagram below to remove the two securing screws.

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7.11.1 Refer to the diagram below to remove the four securing screws and one grounding wire screw.
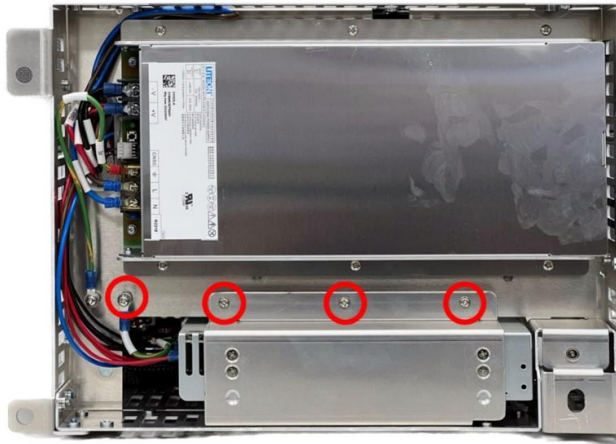
7.11.1 Refer to the diagram below to disconnect the wiring and take out the 24V PSU with the bracket.

7.11.1 Refer to the diagram below to remove the six bracket securing screws and take out the 24V PSU.

7.11.2 During installation, follow the reverse steps of the above procedure. If cable ties were cut, secure the wires again in the original manner

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7.12 Disassembly/Assembly of Filter

7.12.1 Slide the tray upward along the tray slide to remove it
7.12.2 Remove the filter and replace it with a new one.

7.12.3 Reinstall the tray.

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8. Indication Light

8.1 Power board Light Indication

LED Position
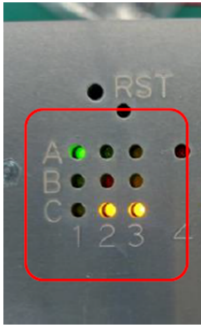
LED Position Corresponding Function

	1	2	3
A	24V Source	Heart-beat	PW!
B	48V PSU	Error	Temp!
C	48V Mode	STO!	ECAT!

LED Position	LED Name	LED Status Description
A1	24V Source	Off = External 24V
		On = Internal 24V
		100ms/100ms Rapid Blink = Internal 24V Error
		500ms/500ms Blink = Internal 24V Current Exceeded
B1	48V PSU	Off = PSU off
		On = (Reserved)
		500ms/500ms Blink = PSU on
C1	48V Mode	Off = 48V off
		On = Normal Mode
		500ms/500ms Blink = Limit Mode
A2	HeartBeart	Off = FW Stuck or Abnormal Protection Pause
		On = FW Stuck
		500ms/500ms Blink = Running
B2	Error	Off = Normal
		100ms/100ms Rapid Blink = ESC Not Ready
		500ms/500ms Blink = Abnormal Protection Pause
		Coding = Error code (Reserved)
C2	STO Alarm	Off = Normal
		On = STO (ESM<OP)
		100ms/100ms Rapid Blink = STO (Low Voltage)
		500ms/500ms Blink = STO (Patriot Act.)
A3	Power Alarm	Off = Normal
		On = 48V & 24V Warning
		100ms/100ms Rapid Blink = 48V Warning

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LED Position	LED Name	LED Status Description
		500ms/500ms Blink = 24V Warning
B3	Temperature Alarm	Off = Normal
		On = PCB & Eater Warning
		100ms/100ms Rapid Blink = PCB Warning
		500ms/500ms Blink = Eater Warning
C3	EtherCAT Alarm	Off = Normal
		On = Packet Loss Warning
		100ms/100ms Rapid Blink = InvalidFrame or RxErr or PUErr counted
		500ms/500ms Blink = PDIErr counted
		1000ms/1000ms Slow Blink = Forwarded RxERR counted

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8.2 End module Indication Light Ring

8.2.1 Special Light Indication

Initializing:	Alternating between Red and Light Off equally
Power On with STO status:	Failed to finish booting up and Light Off (Buzzer no beep)
Power On with SOS status:	Finished booting up and the light indicated as the tables below.
Robot in STO status:	Light Off (Buzzer no beep)
Robot in SOS status:	Light indicated as the tables below.
Updating:	Alternating between Red and Light Off equally (at doubled speed)
Fatal Error(Need to re-boot):	Solid Red Light (Buzzer emits a long beep)

NOTE:

STO (Safe Torque Off)* status condition includes:

1. Category 0 Stop.

2. Category 1 Stop.

3. Emergency Stop function input LOW signal.

SOS (Safe Operation Stop)* status condition includes:

1. Safeguard function Input LOW signal.

2. Enabling Switch function at OFF Status.

3. Under safety configuration status of either safety-related parameters parameterization, Robot Stick MODE Switch function

or Enable/Disable of Robot Stick function.

Refer to *Safety Manual* for details.

*Both names come from IEC 61800-5-2

NOTE:

The different Light Indication of HW3.2 here are:

AUTO Mode: Blue

Recovery Mode: (Not provided in HW3.2)

Maintenance Setting: White

8.2.2 Regular Light Indication

The regular Light Indication alternates between 2 categories of light indication: Operation Mode Light Indication and Auxiliary Light Indication. The blinking ratio of the light indications indicates the various status of the robot. In addition, the display color of Auxiliary Light Indication prioritizes by conditions.

Operation Mode	Running status	Space/Status	Operation Mode Light Indication	Auxiliary Light Indication
MANUAL MODE	Hold to Run or Step Run	Normal	Green (100%)	-
		Error	Green (50%)	Red (50%)
		In Recovery Mode	Green (50%)	Yellow (50%)
		Trigger Maintenance Settings	Green (90%)	Blue (10%)

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Operation Mode	Running status	Space/Status	Operation Mode Light Indication		Auxiliary Light Indication	
		Trigger Human-Machine Safety Settings	Green	(90%)	Purple	(10%)
	Project is running	Normal	Green	(50%)	Light Off	(50%)
		Error	Green	(50%)	Red	(50%)
		In Recovery Mode	Green	(50%)	Yellow	(50%)
		Trigger Maintenance	Green	(50%)	Blue	(50%)
		Settings				
		Trigger Human-Machine Safety Settings	Green	(50%)	Purple	(50%)
	System under SOS status	Normal	Green	(10%)	Light Off	(90%)
		Error	Green	(50%)	Red	(50%)
		In Recovery Mode	Green	(50%)	Yellow	(50%)
		Trigger Maintenance Settings	Green	(10%)	Blue	(90%)
		Trigger Human-Machine Safety Settings	Green	(10%)	Purple	(90%)
AUTO MODE	Project is not running	Normal	White	(100%)	-	
		Error	White	(50%)	Red	(50%)
		In Recovery Mode	White	(50%)	Yellow	(50%)
		Trigger Maintenance Settings	White	(90%)	Blue	(10%)
		Trigger Human-Machine Safety Settings	White	(90%)	Purple	(10%)
	Project is running	Normal	White	(50%)	Light Off	(50%)
		Error	White	(50%)	Red	(50%)
		In Recovery Mode	White	(50%)	Yellow	(50%)
		Trigger Maintenance Settings	White	(50%)	Blue	(50%)
		Trigger Human-Machine Safety Settings	White	(50%)	Purple	(50%)

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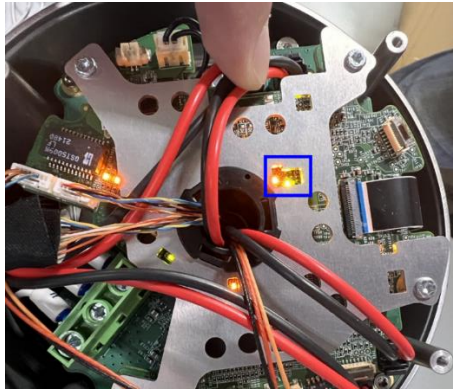|							
	Paused in Project or system under SOS status	Normal	White	(10%)	Light Off	(90%)
		Error	White	(50%)	Red	(50%)
		In Recovery Mode	White	(50%)	Yellow	(50%)
		Trigger Maintenance Settings	White	(10%)	Blue	(90%)
		Trigger Human-Machine Safety Settings	White	(10%)	Purple	(90%)

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8.3 Joint LED Indication

LED Indicator Locations on the Arm Mainboard Assembly

Status		Servo LED (Green)	Error LED (Red)
MCU power on		NA	NA
Error		Error Slow Blink (Refer to the explanation below)	Flashes with Error code (Refer to the explanation below)
FW integrity Fail	Bootstrap	Flashes: Off/On (0.042/0.042 sec)	FW integrity Fail
	Failsafe	Flashes: Off/On (0.168/0.168 sec)	Always On
Without FW		Never On	Never On
Servo on		Fast Blink	Never On
Servo off		Slow Blink	Never On

9. Other Software for support functions

9.1 Debug port

9.1.1 Tool list

Item	Description
Laptop	Used for installing Tera term and CP2102 deriver
USB cable	Used for connecting control box and laptop. **Type C to Type A** is recommended ***Need data transfer function**
CP2102 *Software	To ensure that the laptop correctly detects the debug port Recommended download link: https://www.silabs.com/developers/usb-to-uart-bridge-vcp-drivers?tab=downloads
Tera term *Software	Used for establishing the connection and displaying the information Recommended download link: https://ttssh2.osdn.jp/index.html.en

9.1.2 Power up the control box and connect it to the laptop by using a USB cable.
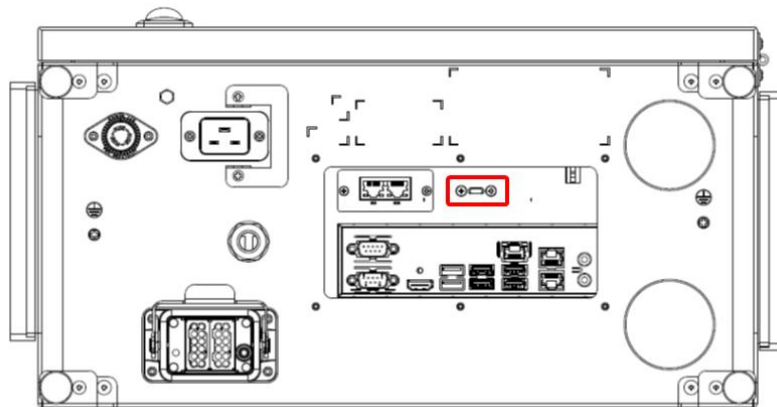
9.1.3 Activate Tera Term and then close the pop-up window by selecting "Cancel" or "Close"
*The COM port number will need to be set at 7.1.5

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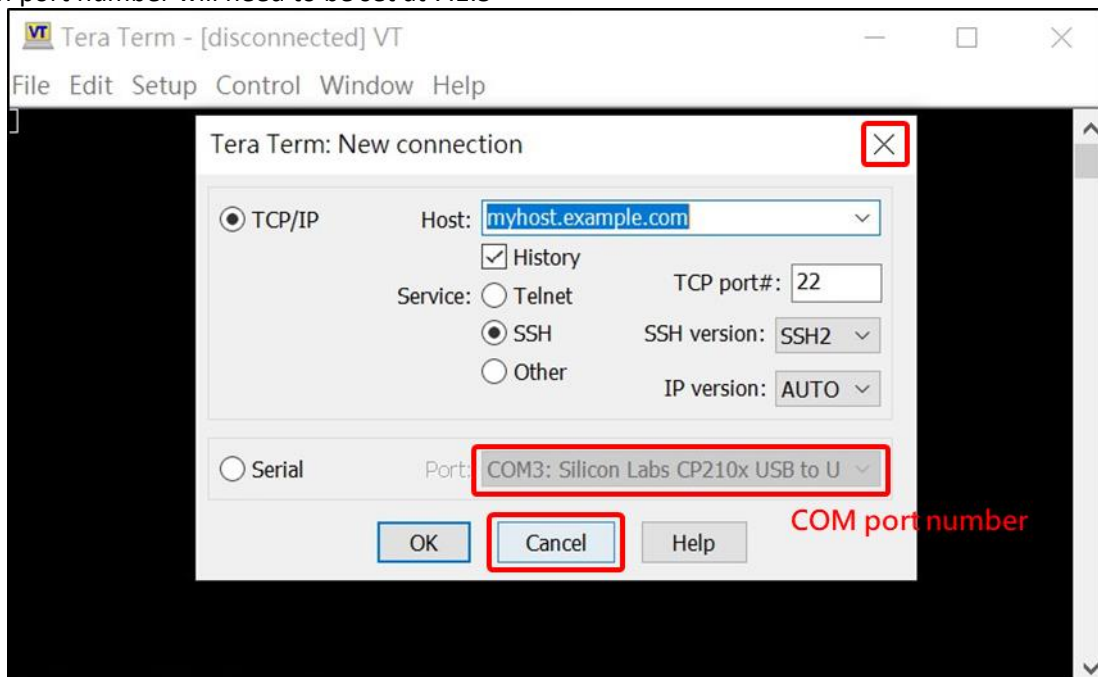
9.1.4 Choose "Setup" and then select "Serial Port"
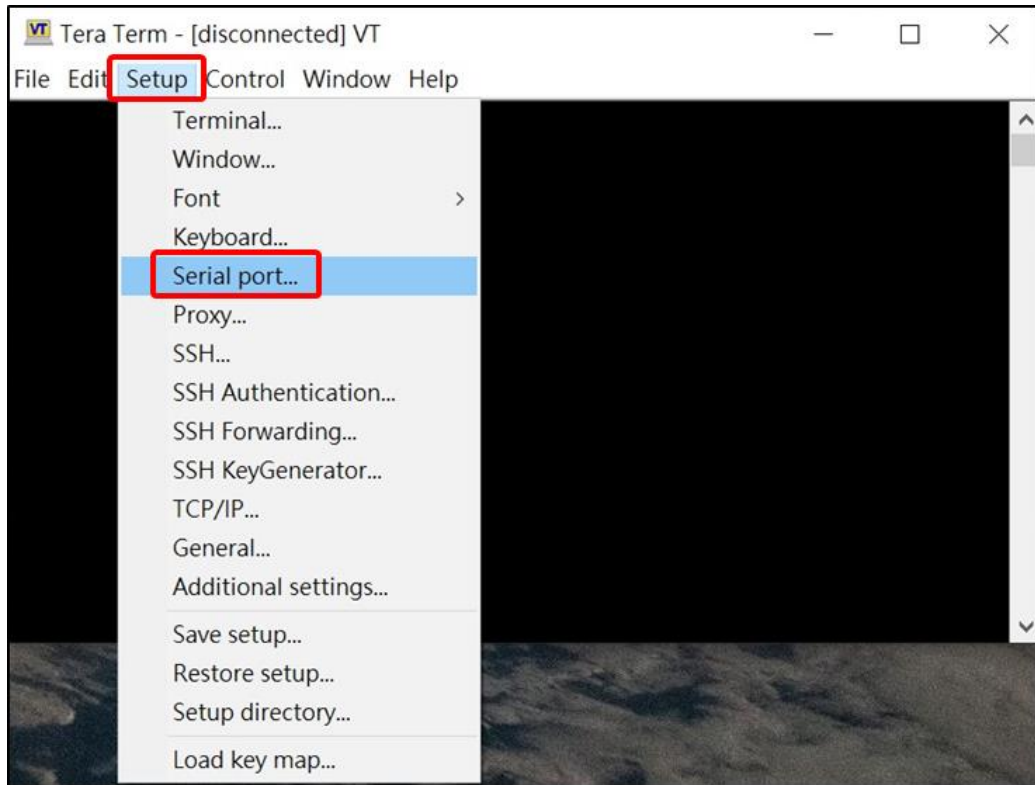
9.1.5 Choose the port as indicated in step 2; set the speed to 926100, and then click on "New open"

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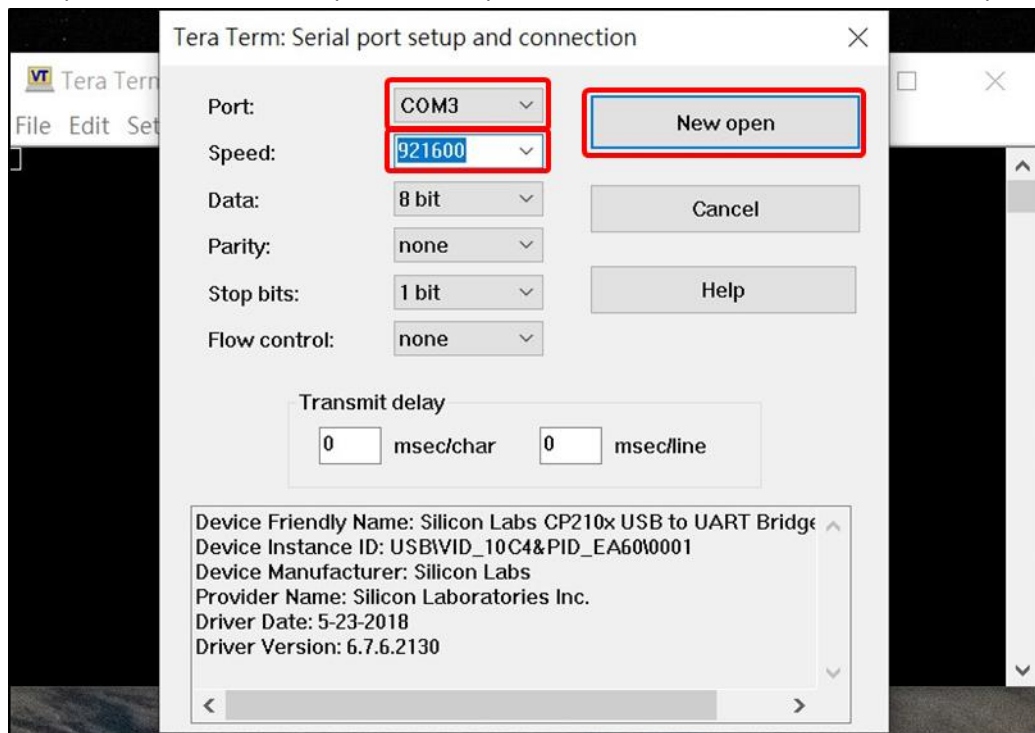
9.1.6 Following screen indicates a successful connection.

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9.2 System recovery

9.2.1 This function is used to restore Disk C to the factory settings, while Disk D (e.g., projects, HMI configurations, etc.) will remain unchanged.

9.2.1 Press the Del key during startup to enter the BIOS.
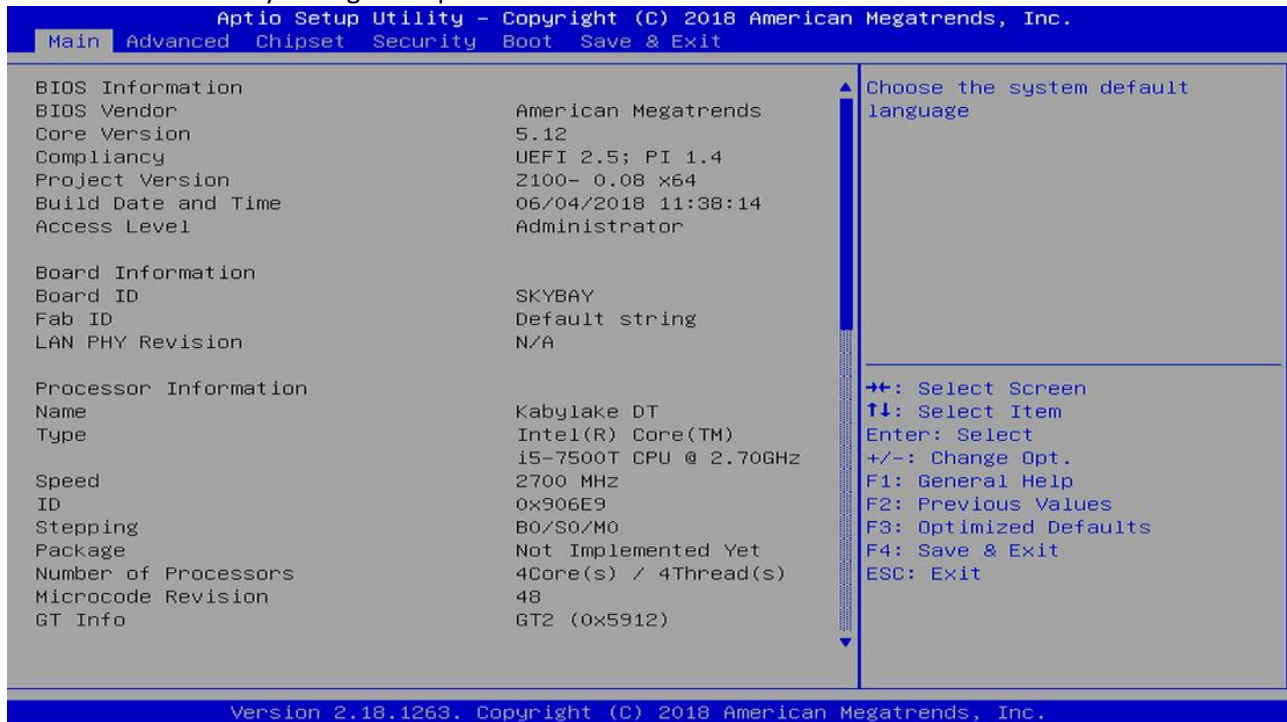
9.2.1 Open the outer casing of the control box, and press and hold the black button on the SSD for more than 5 seconds. The red light will start flashing
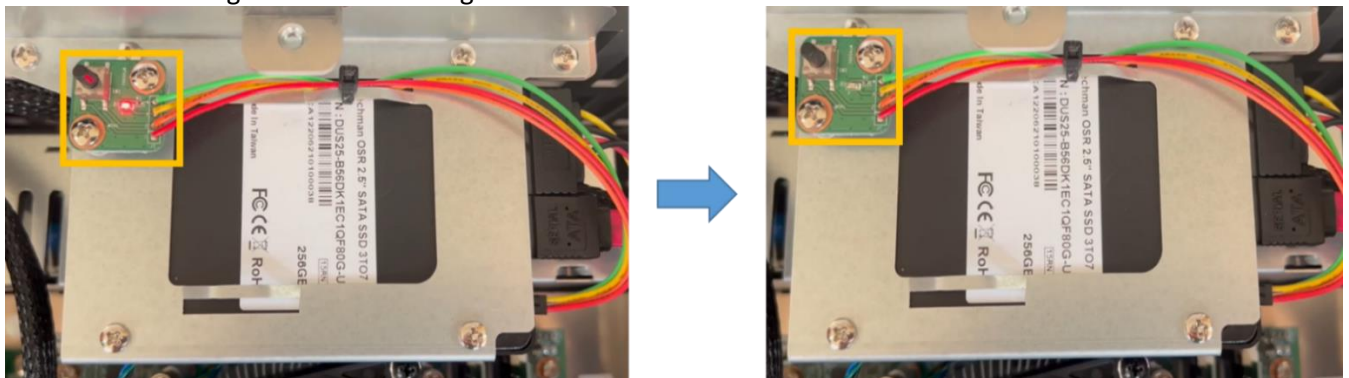
9.2.1 After waiting for 15 minutes, the system will complete the restoration, and the red light will become steady. Once the red light is steady, you can exit the BIOS, restart the system, and Disk C will be restored to its factory state.

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9.3 **Arm Exchange:** This function is designed for situations where either the arm or the control box experiences abnormalities. In cases of urgency, where the customer needs to quickly resume production on the assembly line, arm exchange can be performed to avoid production line downtime. As illustrated below, if Arm A is damaged, this feature facilitates the exchange of Arm A with the available Arm B in stock, enabling the production line to continue operations.
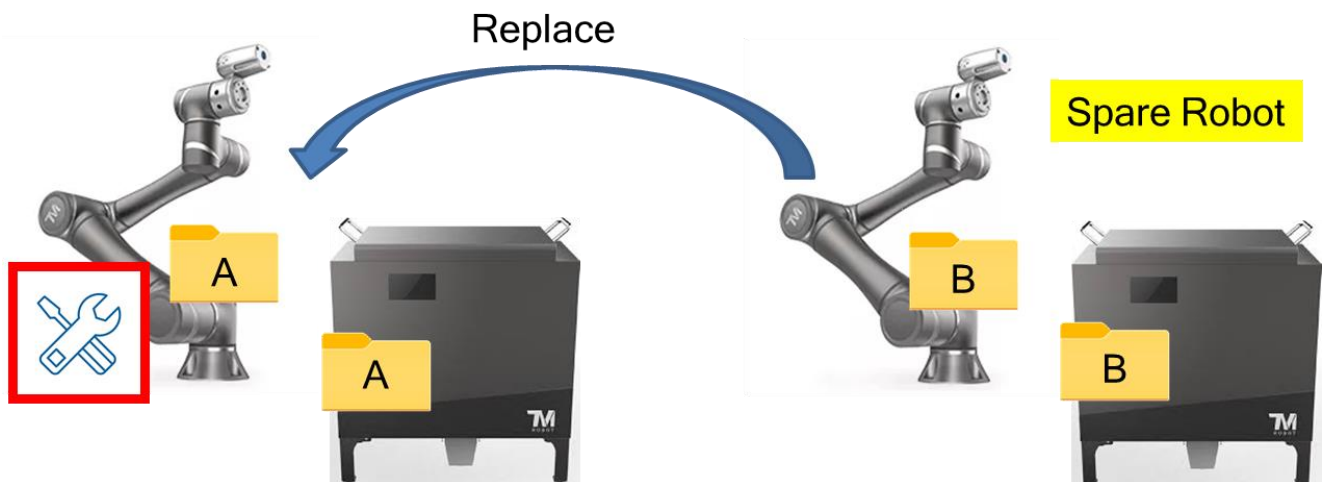
9.3.1 Remove the malfunctioning arm and directly connect the spare arm to the original control box. The calibration data stored in the arm's IO board will overwrite the data in the original control box, so it's crucial to back up the files in the original control box. The software will check whether the data between the arm and control box matches.
The following scenarios will explain the handling when the arm firmware (FW) does not match the control box HMI.

9.3.2 If the arm FW is version 2.12 but the spare control box's HMI version is 2.14, the user can choose to restore the control box's HMI image to version 2.12 or upgrade the arm FW to version 2.14.

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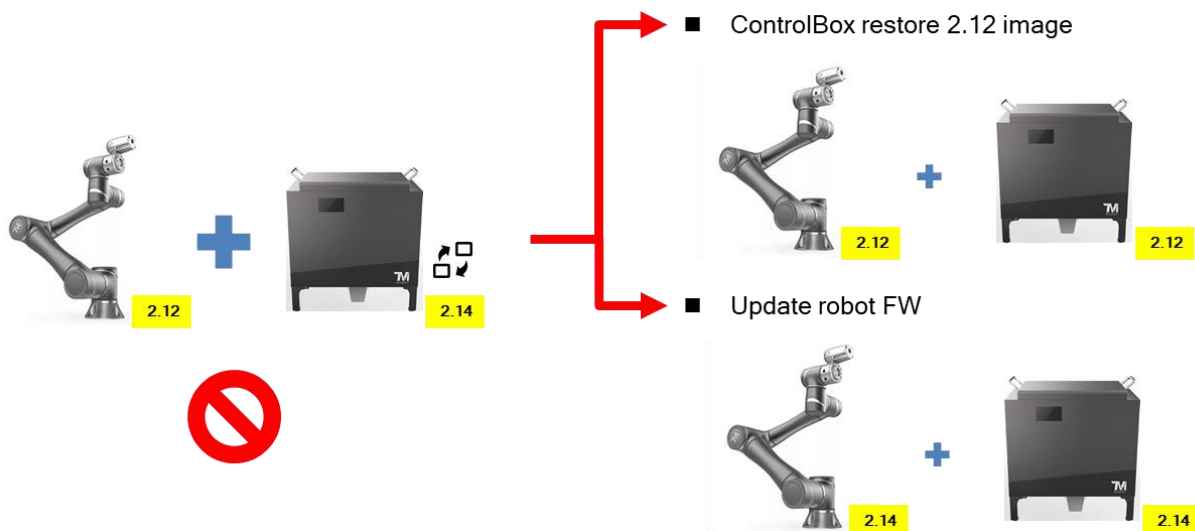
9.3.1 Joint type When the arm FW is version 2.14, but the spare control box's HMI version is 2.12, the user can only upgrade the control box's HMI to match the FW. The main reason is that older versions of software or firmware may not recognize the new Joint type.
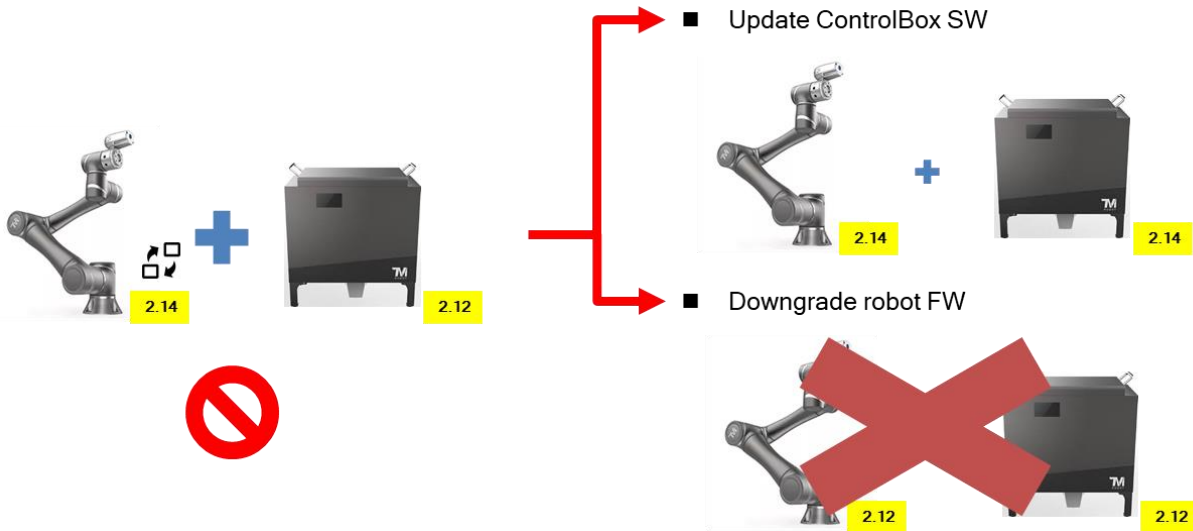
9.3.2 Not every arm and control box can support interchangeability. Exchange can only occur when Arm Model and Control Box Model are mutually compatible. TM25S can only exchange the arm and control box woth same model.

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9.3.3 The flowchart below showing the process that the system will follow in the background after swapping the arm with the control box. If there are no errors or anomalies during the process, it is considered a successful interchange. For troubleshooting in case of abnormal situations, please refer to the Appendix.

Replacement robot/ control Box

Boot up

Check if the Model ID matches any parameters in the table

No → Boot Failure
Appendix 1

Yes

Was the download of data to the arm successful?

No → Is there a service key?

Yes

Is the data version on the robot/control box compliant with the rules?

Yes → Error page (1)
Appendix 2

No → Error page (2)
Appendix 3

Yes

Each unit checks whether the files on the arm are normal?

Maintenance personnel need to recalibrate/update data on the arm/update the version of the electrical control box.

Yes

Each unit checks whether the files on the arm/electrical control box match?

No → Is there a need to replace the arm?

Yes

Yes → Transfer data from the arm to the control box

No

Normal Boot

Power off

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- This issue indicates that the arm and control box combination may not support interchangeability. Please double-check the compatibility list to ensure that the combination is valid. If it is a valid combination and you still encounter this problem, it is recommended to contact the headquarters' engineers for further assistance.

Appendix 2
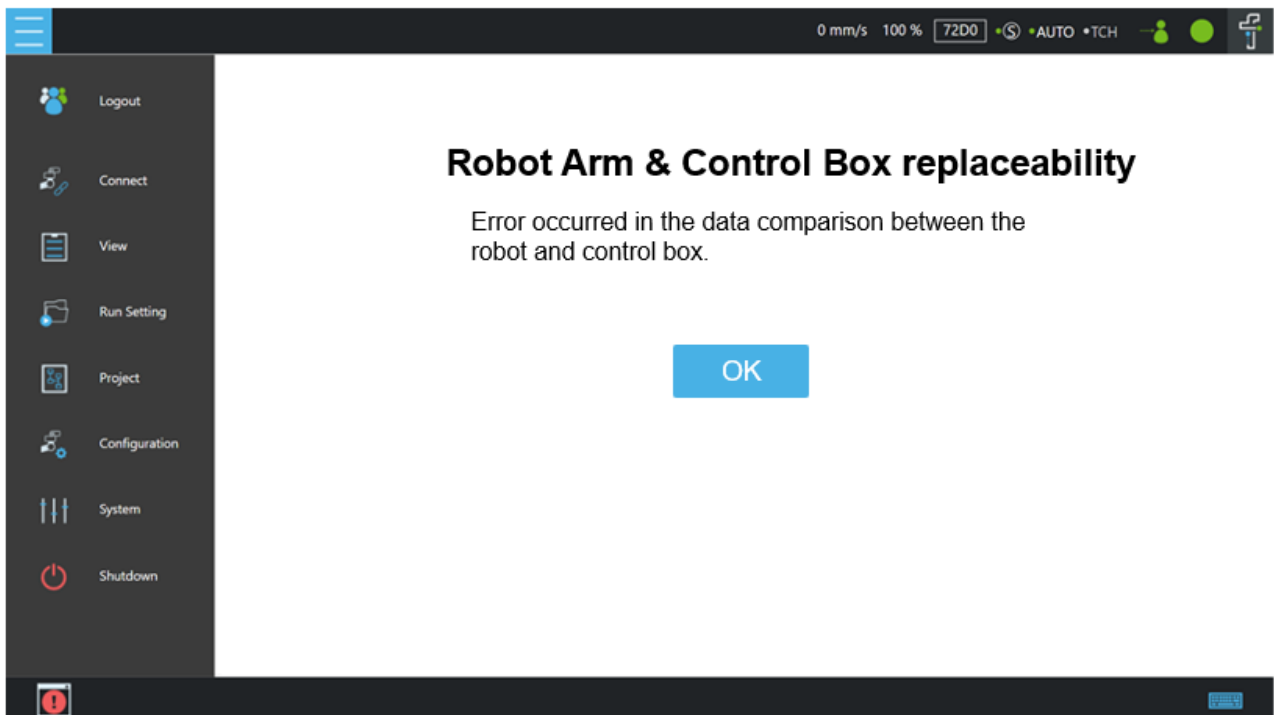
- This error indicates a data comparison issue, and it may trigger a special page with log entries such as 0x00045240 (download failed or data error) or 0xF0000180 (version comparison failed).
- The maintenance personnel need to recalibrate/update arm-end data/update control box version.

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Appendix 3
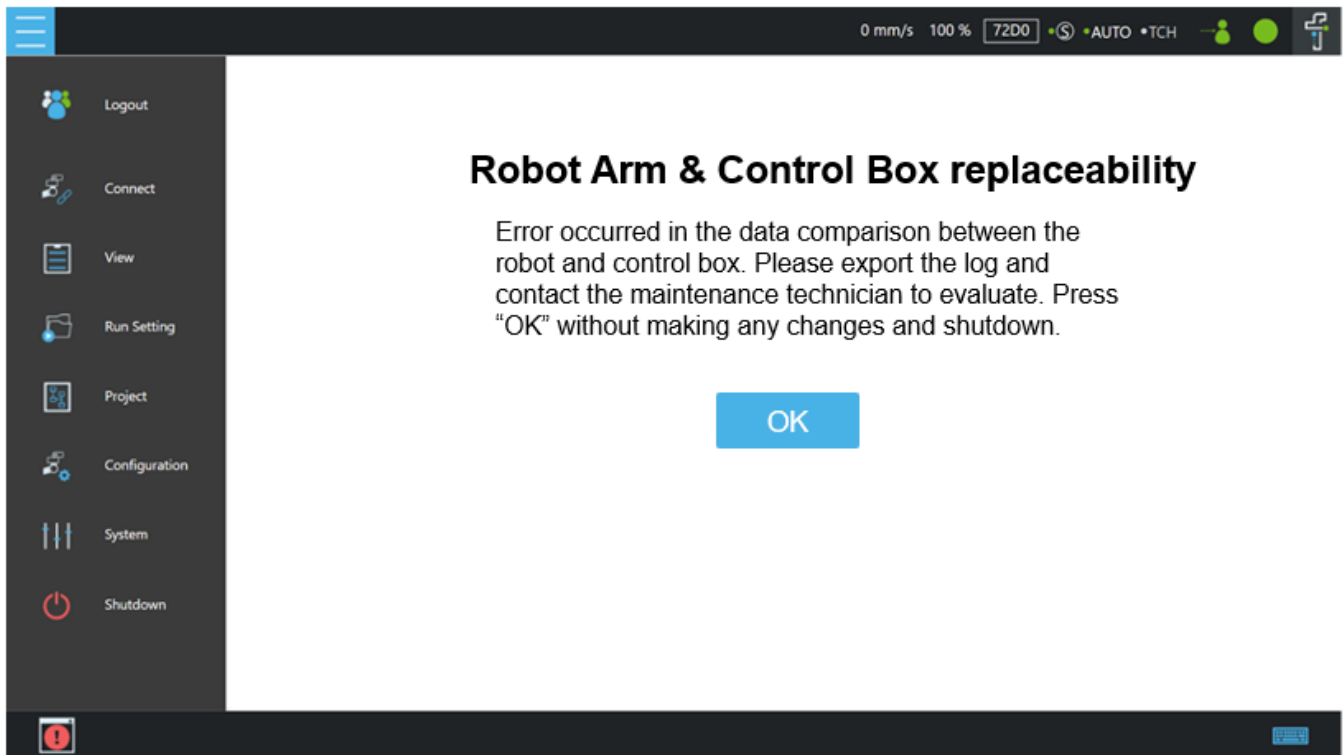
- The error message "Data comparison error prompts a special page and logs 0x00045240 (download failed or data error) or 0xF0000180 (version comparison failed). Please export the logs and contact the headquarters maintenance personnel for assistance

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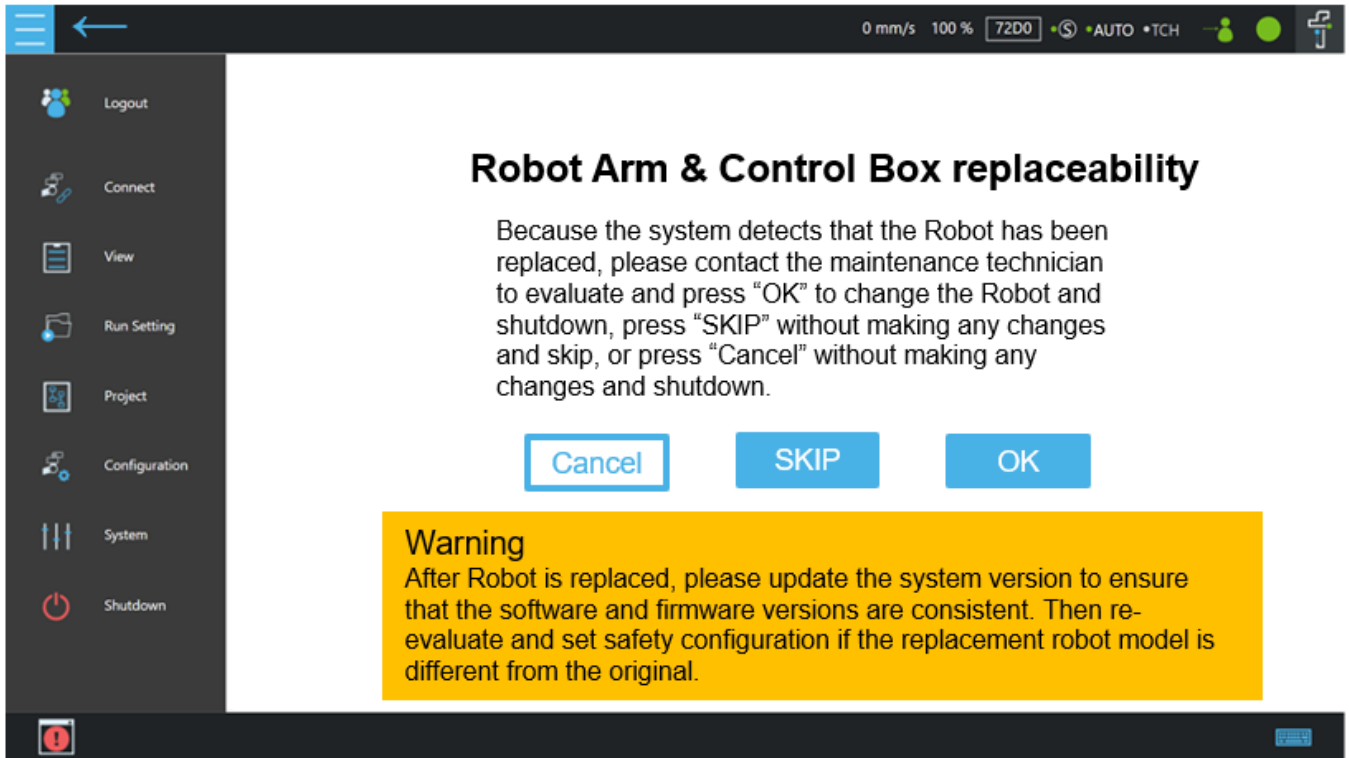
If all the above criteria are met, but the data on the arm side differs from the data on the control box side, switch to this special page after turning on the machine.

Cancel : Do not make any changes. Click to initiate the shutdown procedure.

SKIP：No changes needed. Click to exit this special page. If there is no service key, the button will be greyed out and cannot be clicked.

OK : Overwrite the data of the arm side to the control box side, and switch off the machine, if there is no Service key, the button will be greyed out and cannot be clicked.

Note: The visual connection camera check takes approximately 60 seconds. During Normal power on, the page may jump to this special page after a period of time. The check will first go to the Normal condition, and then jump to this special page when any unit is checked to a different condition.

Please click 'OK' and enter the Safety Password to confirm the arm change. This password is the same as the Safety Configuration Tool Password.

After replacing the arm, update the system version to ensure the firmware version remains the same. If the arm model has been changed, conduct a new safety assessment and modify the safety function settings

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10. Calibration guide

Reference the order of images in the following sections for calibration.

Contents
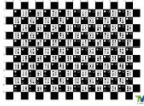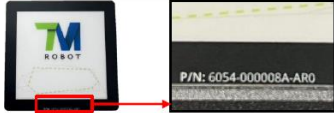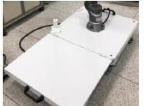
1. Tools and space
2. Settings for calibration (HW5.02 ONLY)
3. Dynamic calibration and Hand-guide calibration
4. Camera calibration
5. Kinematic calibration
6. Hand-eye calibration and Verification
7. Barcode setting
8. Save the calibration data (HW5.02 ONLY)
9. Snake dance

Important notes:

1. To avoid collisions, the gripper, external cables, and external equipment must be removed before performing calibration.
2. For the X-version robot without a camera, only **Dynamic Calibration** and **Hand-Guide Calibration** need to be performed.
3. **Camera Calibration** is required only when replacing the End Module or camera. If a Joint is replaced, perform **Kinematic Calibration**, **Hand-Eye Calibration**, **Verification**, and **Barcode Setting**.
4. Before calibration, ensure the robot is securely mounted to the platform, and that the platform remains stable without any shaking during arm movement.
5. Move the robot to the **Home Pose** while powered on and confirm there is no backlash or misalignment in any joint.
6. During calibration, use standard indoor lighting as the primary light source. Additional lighting is unnecessary unless in special environments with insufficient or unstable lighting.
7. To maintain stability in the relative position between the robot and the calibration plate, both must be mounted on the same platform.

10.1 Tools and space

Tools and space		
1	Maintenance dongle	
2	Small dice board *Only the new calibration plate can be used (the new version has a smooth touch, whereas the old version has noticeable printed texture when touched).	
3	Big dice board *Only the new calibration plate can be used (the new version has a smooth touch, whereas the old version has noticeable printed texture when touched).	
4	Landmark *Only the new aluminum anti-reflective version of the Landmark (with part number 6054-000008A-AR0 at the base) can be used, and ensure the protective film on top has been removed.	
5	Calibration plateform	

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Tools and space

Ensure that there is enough space to perform the calibration.

TM25S

Ø 3805.9
Ø 3500.0
166.0° 166.0°
Ø 520.2
Ø 3811.2 (5 DOF)
Ø 3502.8 (6 DOF)

Tools and space

Ensure that there is enough space to perform the calibration.

TM30S

Ø 3405.9
Ø 3100.0
170.0° 170.0°
Ø 532.0
Ø 3411.5 (5 DOF)
Ø 3103.2 (6 DOF)
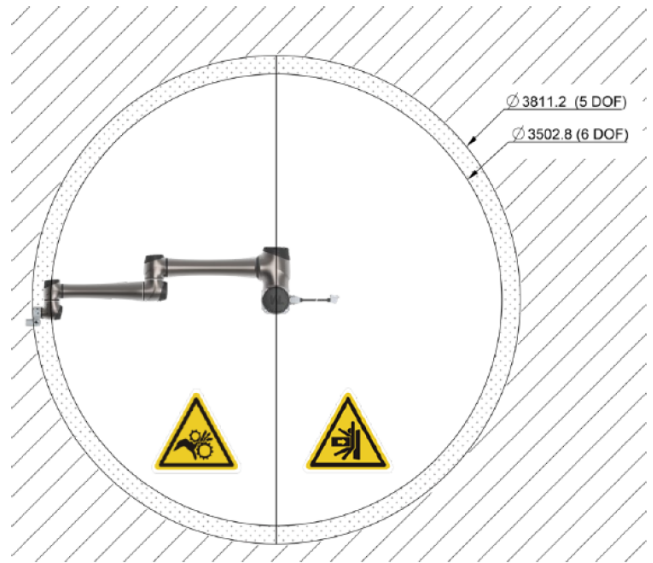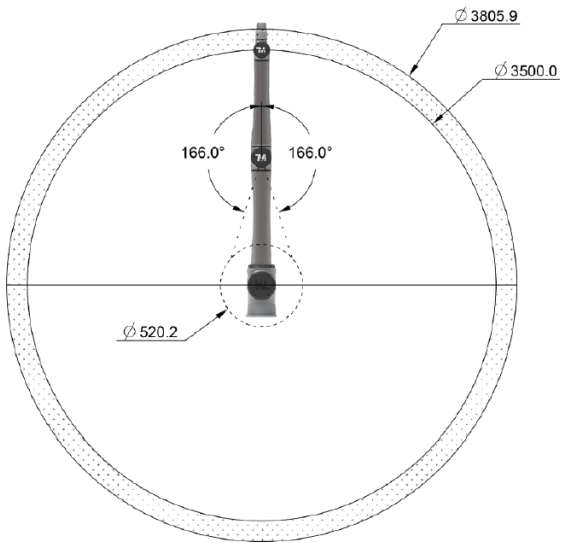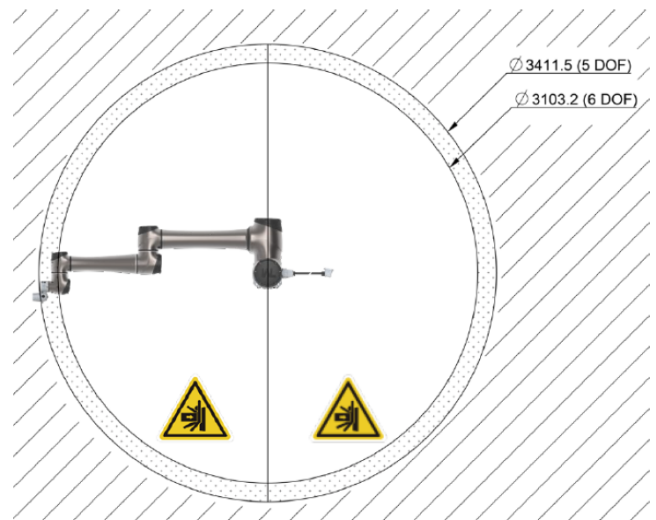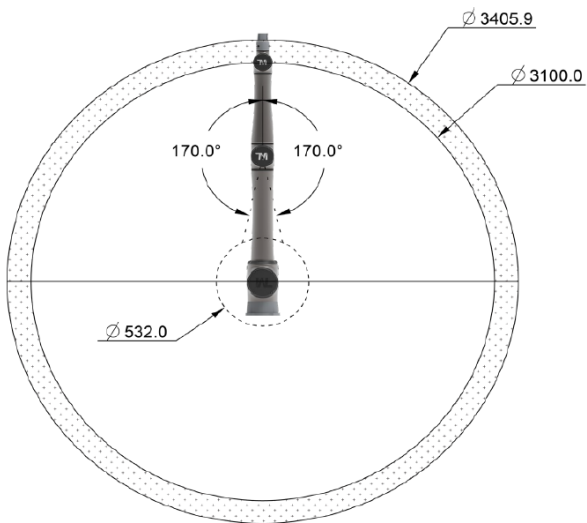
10.2 Settings for calibration

Settings for calibration

*Please restore the following settings after the calibration process is completed.
*Insert the maintenance dongle before perform following steps and calibration.

1. Select menu

▼ Configuration
Tool Settings
Safety → 3. Select Safety
Vision Settings
TM AI+
Connection Settings
Component
2. Select
TMcraft Management
I/O Setup
End Button
Motion Settings
Text File Manager
▶ System
▶ Others

Settings for calibration

0 mm/s 100 % D22A •Ⓢ •AUTO •TCH
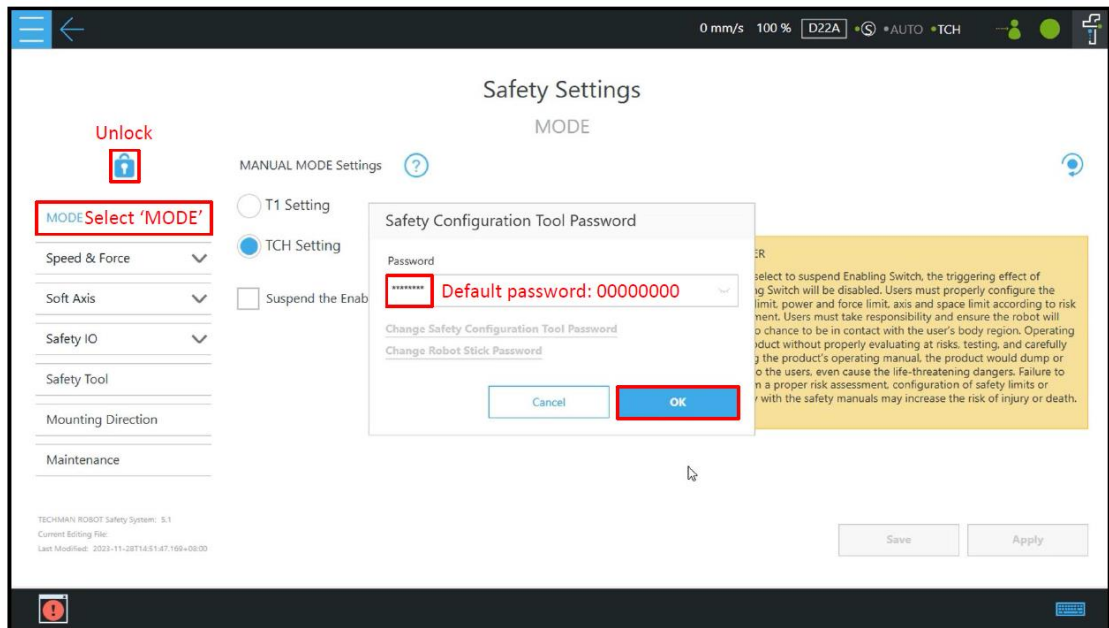
Safety Settings
MODE

Unlock

MANUAL MODE Settings ?

MODE Select 'MODE'

○ T1 Setting

Speed & Force

● TCH Setting

Safety Configuration Tool Password

Soft Axis

Password

Safety IO

□ Suspend the Enab

••••••• Default password: 00000000

Safety Tool

Change Safety Configuration Tool Password

Mounting Direction

Change Robot Stick Password

Maintenance

Cancel   OK

TECHMAN ROBOT Safety System: 5.1
Current Editing File:
Last Modified: 2023-11-28T14:51:47.169+08:00

Save   Apply

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Settings for calibration

Settings for calibration

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Settings for calibration

Settings for calibration

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Settings for calibration
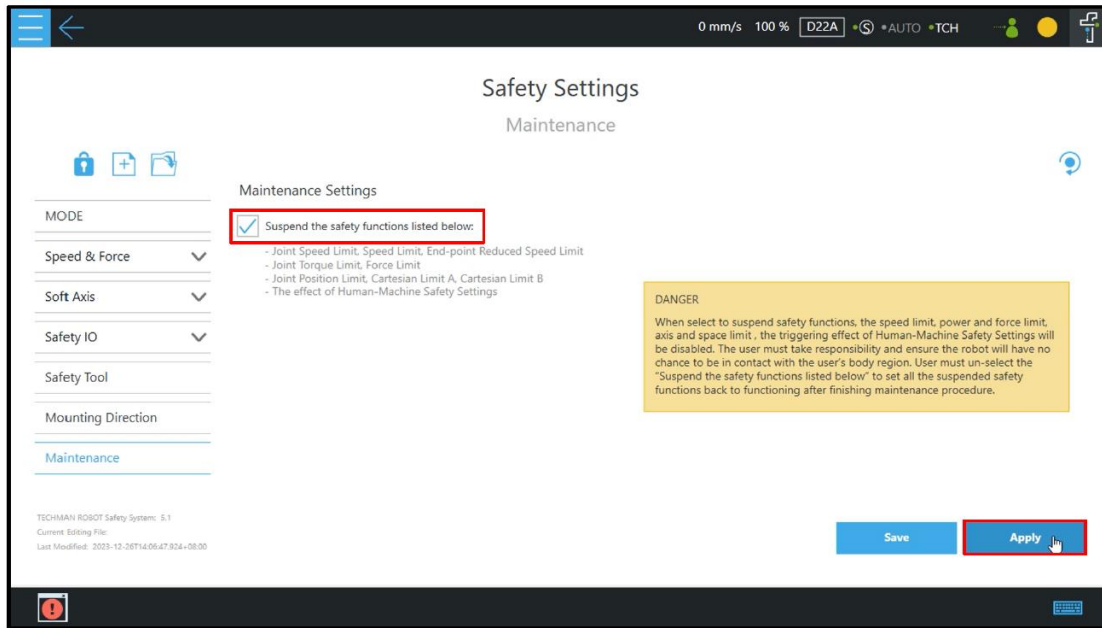
Settings for calibration

10.3 Dynamic calibrationand Hand-guide calibration

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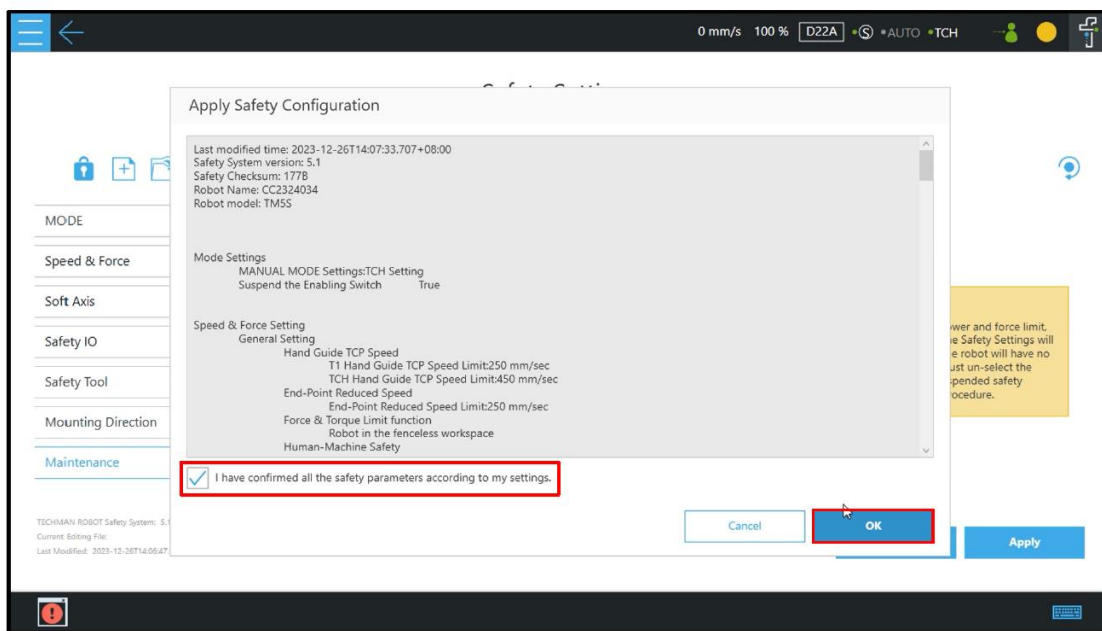
Dynamic calibration and Hand-guide calibration – Dynamic calibration

1. Select the @TMField_DynamicCalibration
2. Switch the robot into auto mode and run the project.
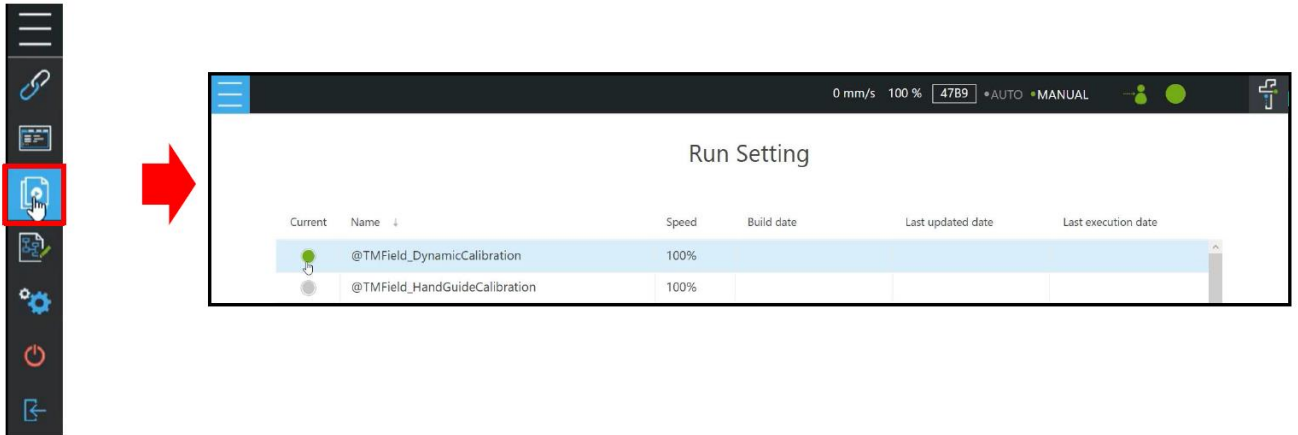
Dynamic calibration and Hand-guide calibration – Dynamic calibration

Dynamic calibration is running
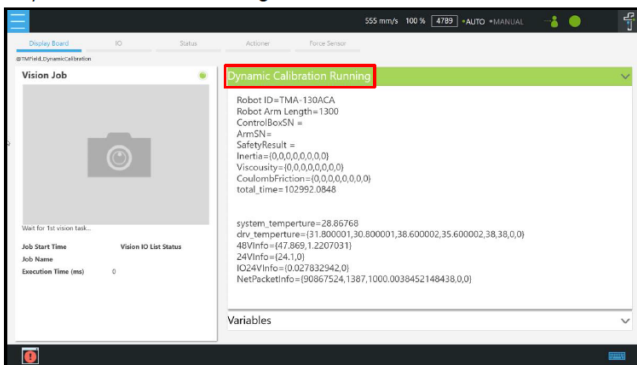
Dynamic calibration completed

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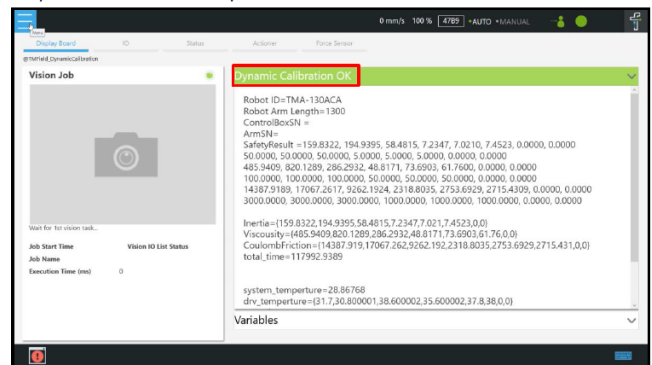
Dynamic calibration and Hand-guide calibration – Hand-guide calibration

1. Select the @TMField_HandGuideCalibration
2. Switch the robot into auto mode and run the project.
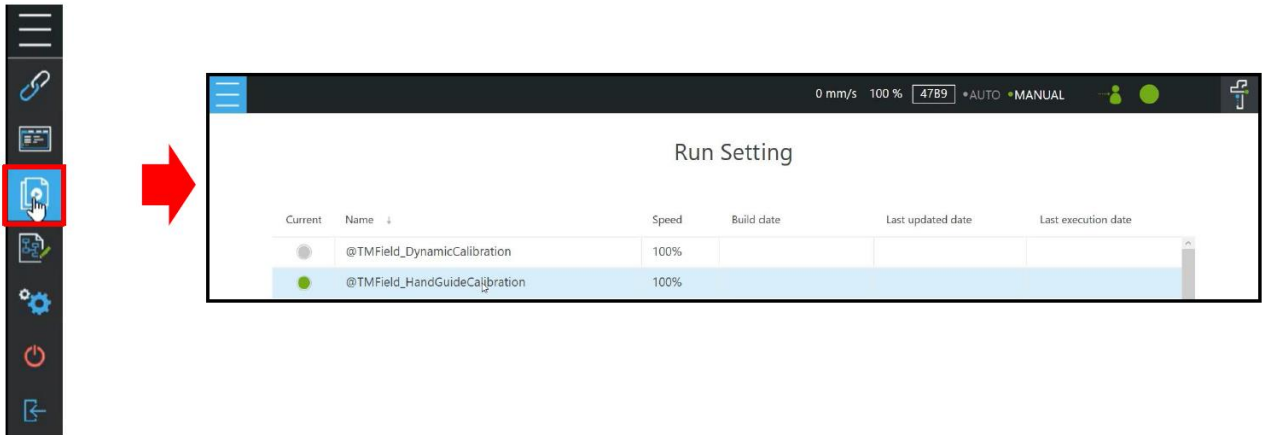
Dynamic calibration and Hand-guide calibration – Hand-guide calibration

Hand-guide calibration is running
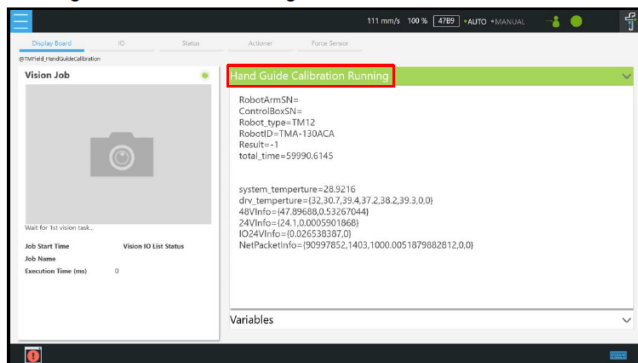
Hand-guide calibration completed

10.4 Camera calibration

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Camera calibration

1. Select menu
2. Select
3. Select Maintenance mode

Camera calibration

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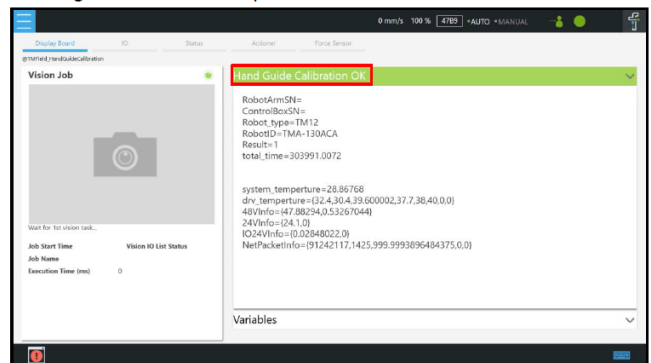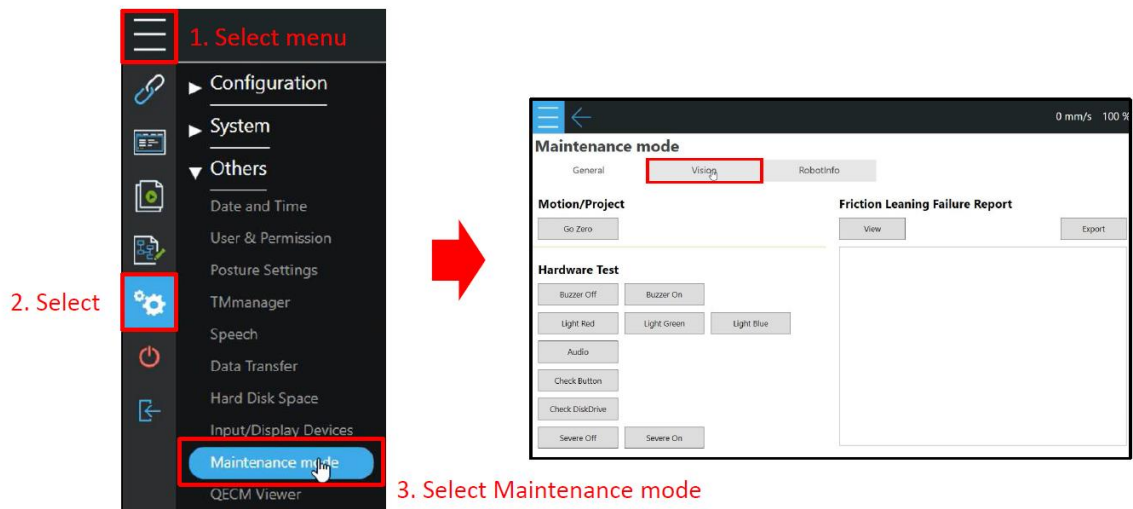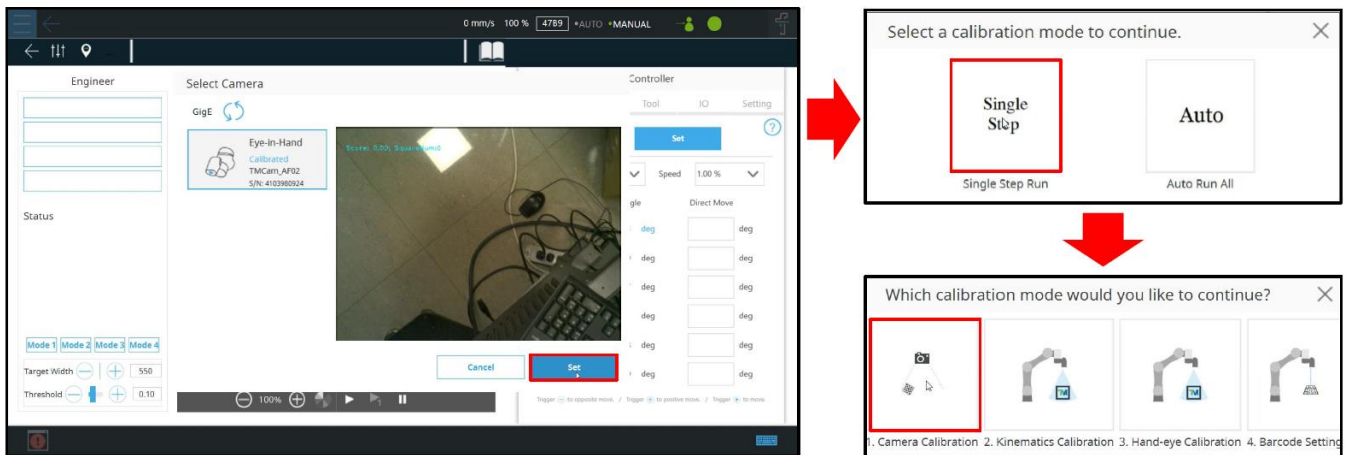
Camera calibration

1. Use ① to move the robot to the designated position, then place the **small dice board** and make sure the camera can see the entire dice board as shown in ②
2. Use ③ to adjust the parameters (Activate the built-in light and set the values as 255; for other settings, click Auto once)
3. After setting up, click ④1-cm Plate Calibration to start the calibration

Camera calibration

1. Setting up the **big dice board** properly after 1-cm Plate Calibration(small dice board) is completed.
2. Run 2-cm Plate Calibration.

Camera calibration

2-cm Plate Calibration completed.
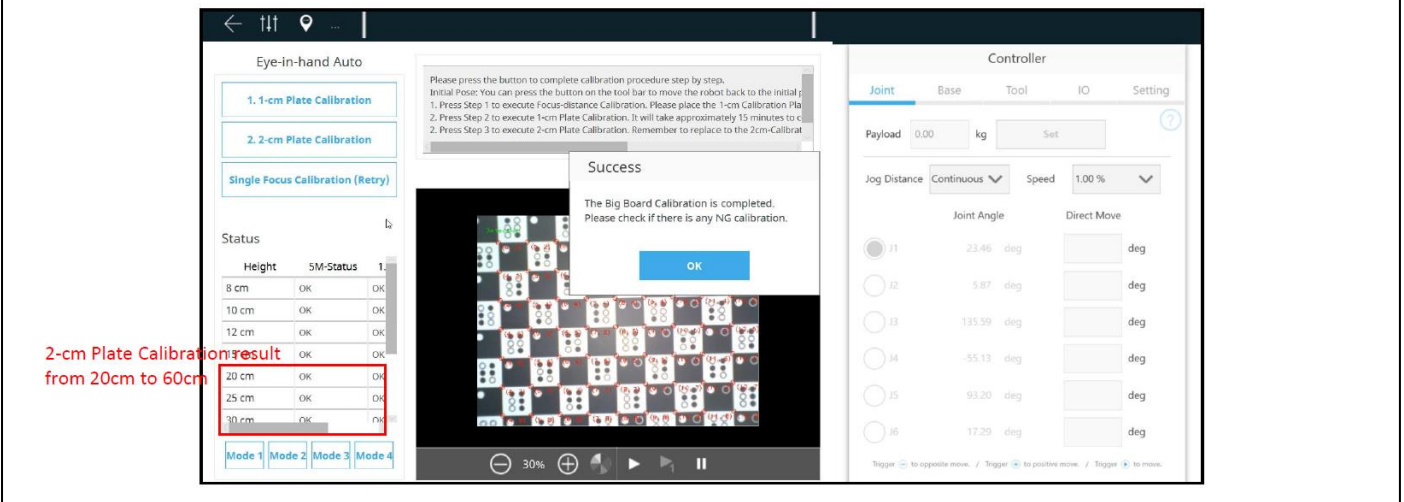
Camera calibration

1. If there is any status showing 'not finished' after completing the 2-cm Plate Calibration, use 'Single Focus Calibration' for re-calibrating.
2. E.g. 20cm 5M-Status failed. So the 'Board' setting would be 2cm, 'Focus height' would be 20, 'Resolution' would be 5M. Put the big dice board on the camera FOV and click Next.
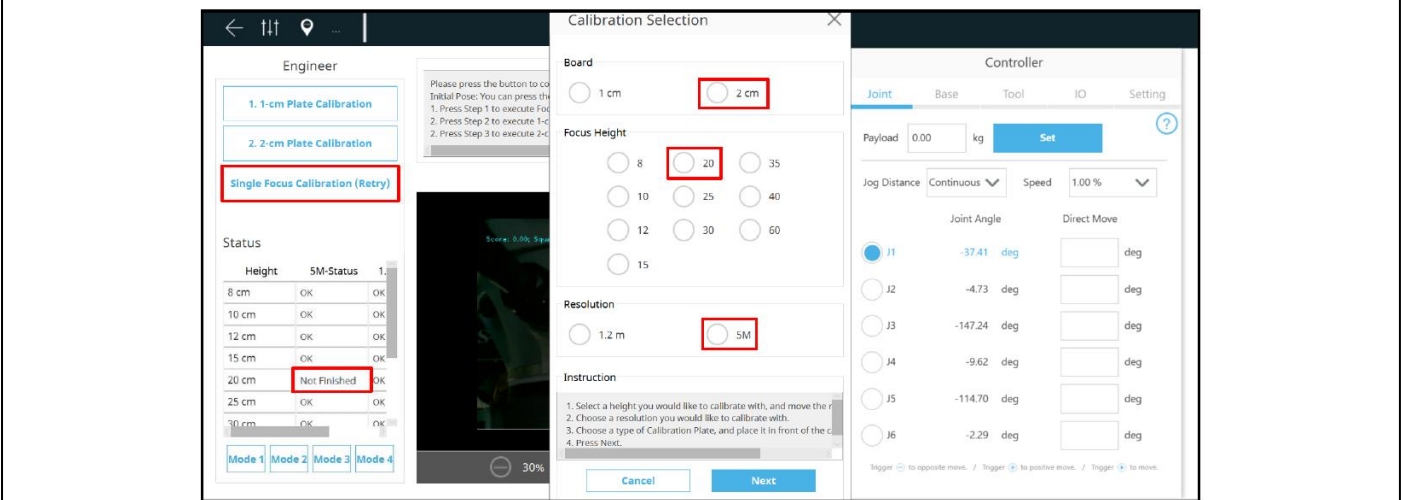
10.5 Kinematic calibration

Kinematic calibration

1. Select menu

2. Select

3. Select Maintenance mode

Kinematic calibration

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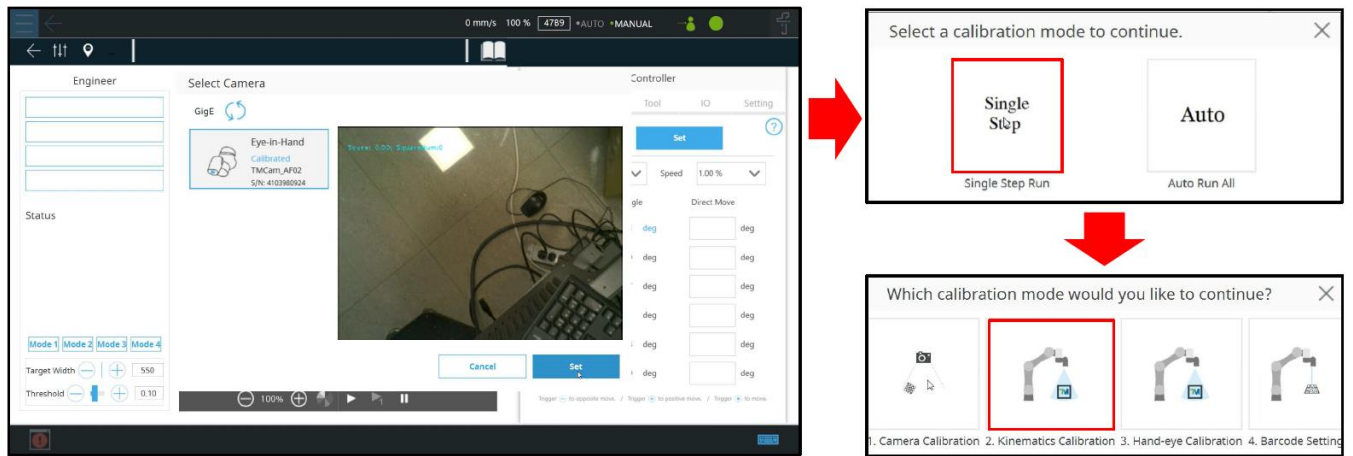
Kinematic calibration

1. Click "Move to Initial Position" to move the robot to its initial position.
2. First, place the Landmark at position (0, 0, 100) relative to the camera (Figure A). Then, remove the Landmark and replace it with the 1 cm calibration plate, ensuring the entire camera view is covered by the calibration plate (Figure B).
3. Set the camera parameters sequentially (Figure C) and save the settings.
4. After completing the parameter setup, remove the 1 cm calibration plate and place the Landmark back at position (0, 0, 100) relative to the camera (Figure A, or align the red and green frames in the camera view). Click "Kinematic Calibration" to start the calibration process.
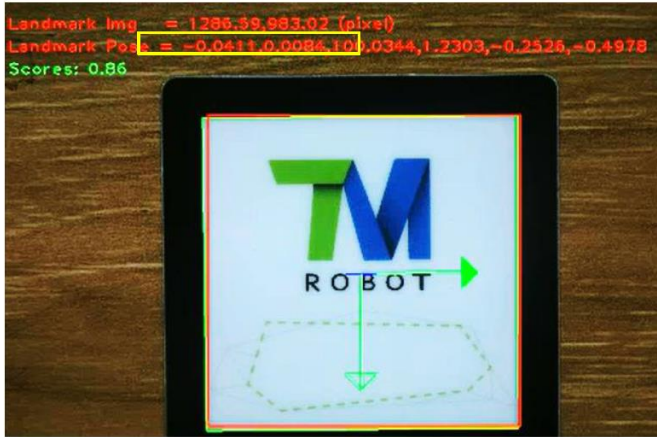
(A)Landmark placement position
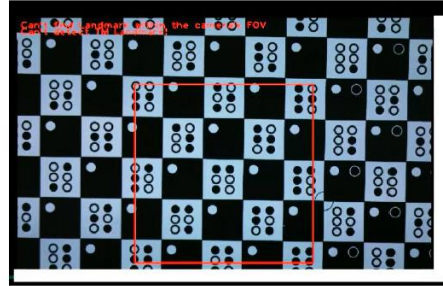
(B)Place 1 cm calibration plate

1. Built-in lighting: Enable and set the value to 255
2. Shutter Time: Set to 5000. Increase the value only if the light source is unstable or insufficient.
3. Gain: Set to 0
4. White balance: Press "Auto once"   (C)Set camera parameter
5. Focus: Set to 3

Kinematic calibration

1. Calibration will terminate after completing 40 successful calibrations (FinishTimes) or 15 failed calibrations (FailTimes).
2. After calibration, if the error value is below 0.3, the calibration is considered successful. If the error value exceeds 0.3 or the calibration fails, provide the following to Techman: **Camera view images, photos of the environment, video of the calibration process, Logs from the same day.**

10.6 Hand-eye calibration and verification

Hand-eye calibration & Verification

1. Select menu
2. Select
3. Select Maintenance mode

Hand-eye calibration & Verification

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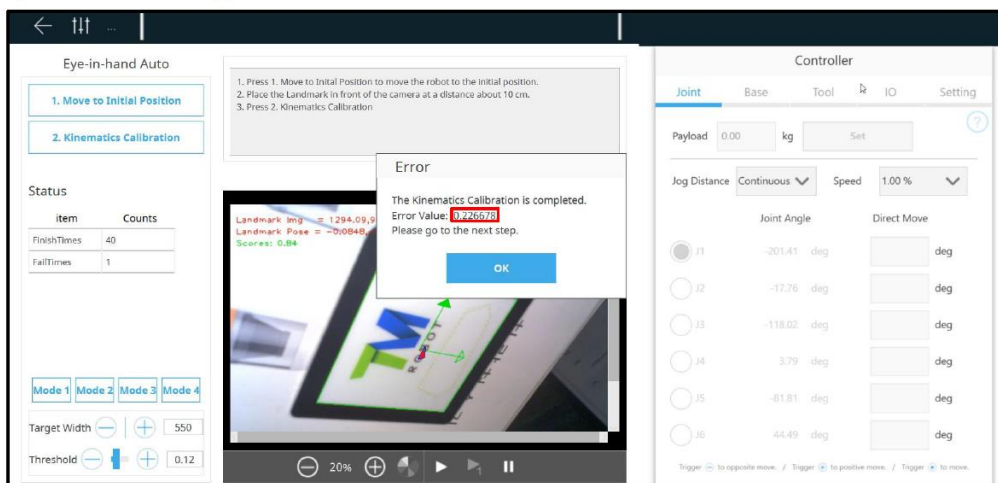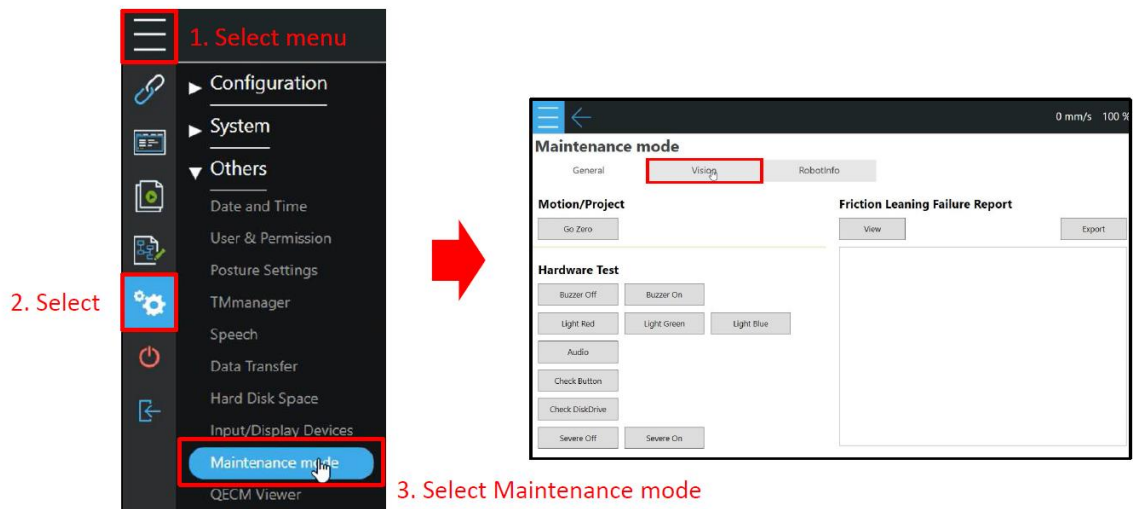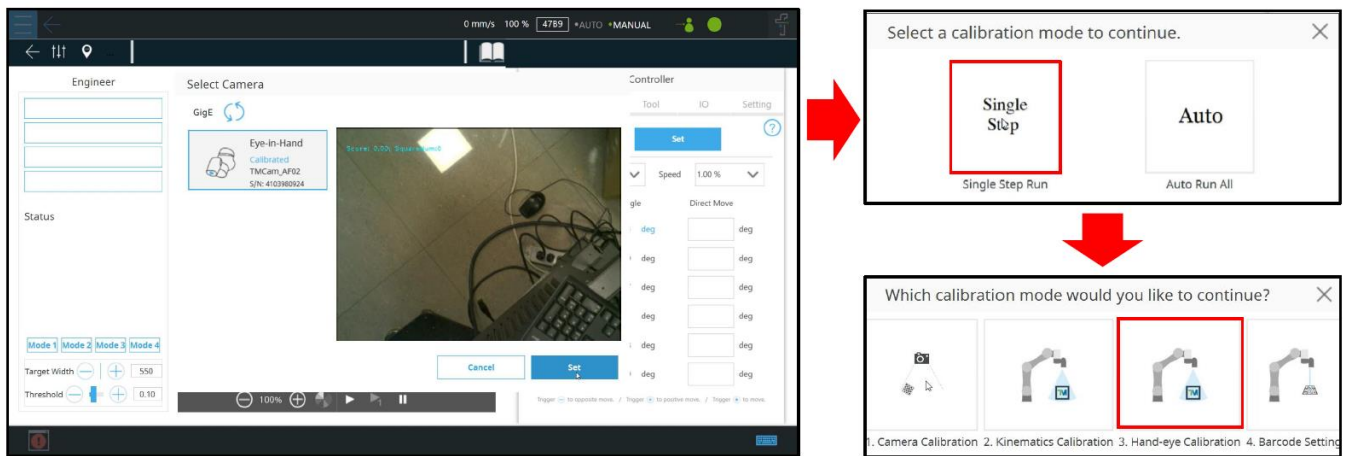
Hand-eye calibration & Verification

1. Press 'Move to Calibration Position' to move the robot to the designated position.
2. Continue using the calibration position and camera parameters from the Kinematic Calibration.
3. Press 'Hand-eye Calibration'.
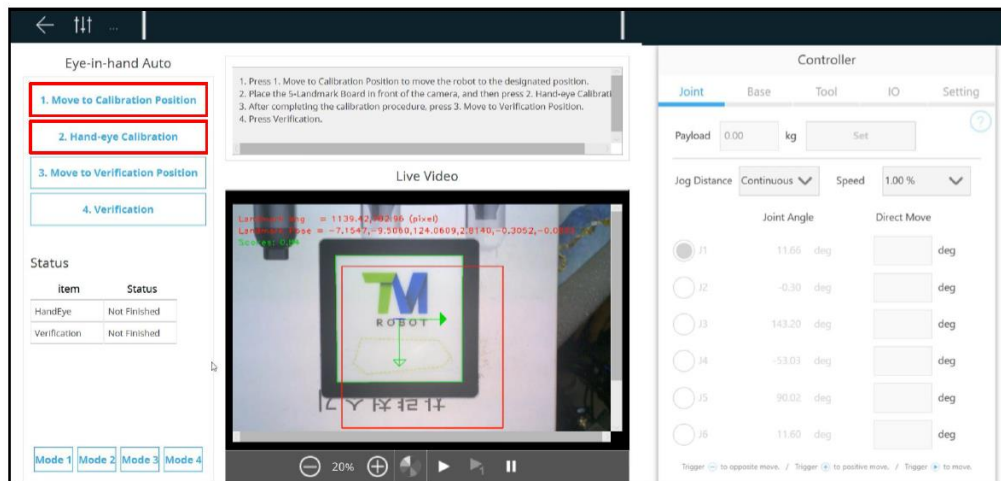
Hand-eye calibration & Verification

1. After completing the calibration, if the error value is below 0.3, the calibration is considered successful.
2. If the error value exceeds 0.3 or the calibration fails, send the following to Techman: **Camera view images, photos of the environment, video of the calibration process, Logs from the same day**

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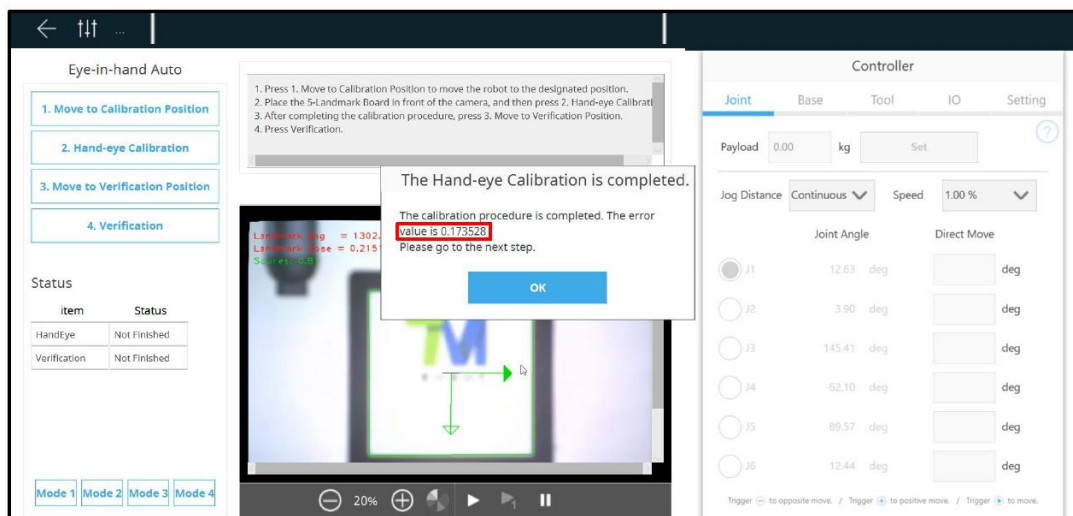
Hand-eye calibration & Verification

1. Press 'Move to Verification Position' to move the robot to the designated position after completing the hand-eye calibration.
2. Place the **small dice board**, turn on the camera light, and adjust camera parameters to ensure the small dice board can be detected. Then press 'Verification'.
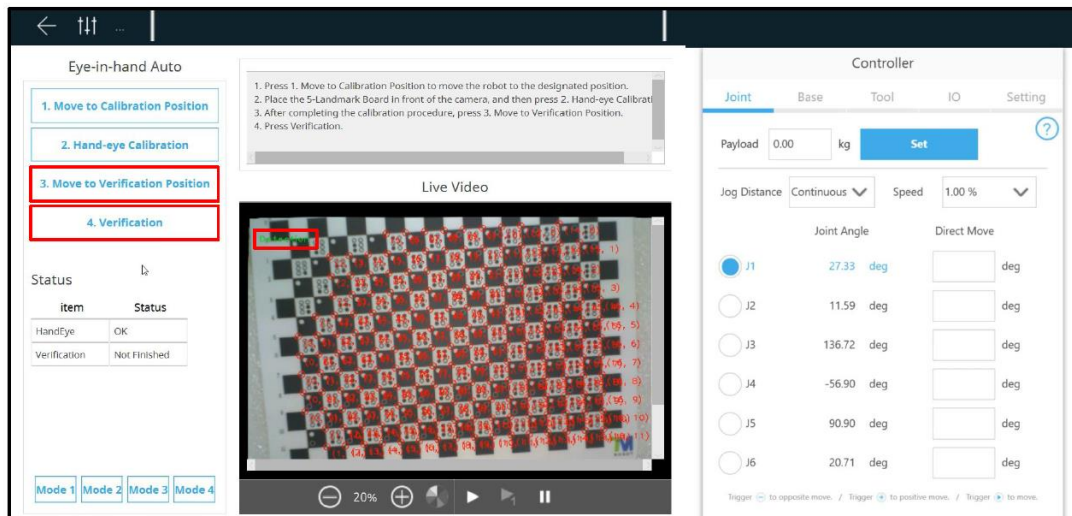
Hand-eye calibration & Verification

1. After calibration is complete, please ensure that the first and second values are below 0.5, and the third and fourth values are below 1.
2. If any of the values exceed the specified limits, please redo the Hand-eye calibration and Verification.
3. If the error value exceeds 0.3 or the calibration fails, send the following to Techman: **Camera view images, photos of the environment, video of the calibration process, Logs from the same day**

10.7 Barcode setting

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Barcode setting

1. Select menu

▶ Configuration

▶ System

▼ Others

Date and Time

User & Permission

Posture Settings

2. Select

TMmanager

Speech

Data Transfer

Hard Disk Space

Input/Display Devices

Maintenance mode

QECM Viewer

3. Select Maintenance mode

Maintenance mode

General   Vision   RobotInfo

Motion/Project   **Friction Leaning Failure Report**

Go Zero   View   Export

Hardware Test

Buzzer Off   Buzzer On

Light Red   Light Green   Light Blue

Audio

Check Button

Check DiskDrive

Severe Off   Severe On

Barcode setting

Select a calibration mode to continue.

Single Step   Auto

Single Step Run   Auto Run All

Which calibration mode would you like to continue?

1. Camera Calibration 2. Kinematics Calibration 3. Hand-eye Calibration 4. Barcode Setting

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Barcode setting

1. Press 'Move to Barcode Position' to move the robot to the initial position.
2. Press 'Camera Parameter Auto Once' to set the camera parameter automatically.
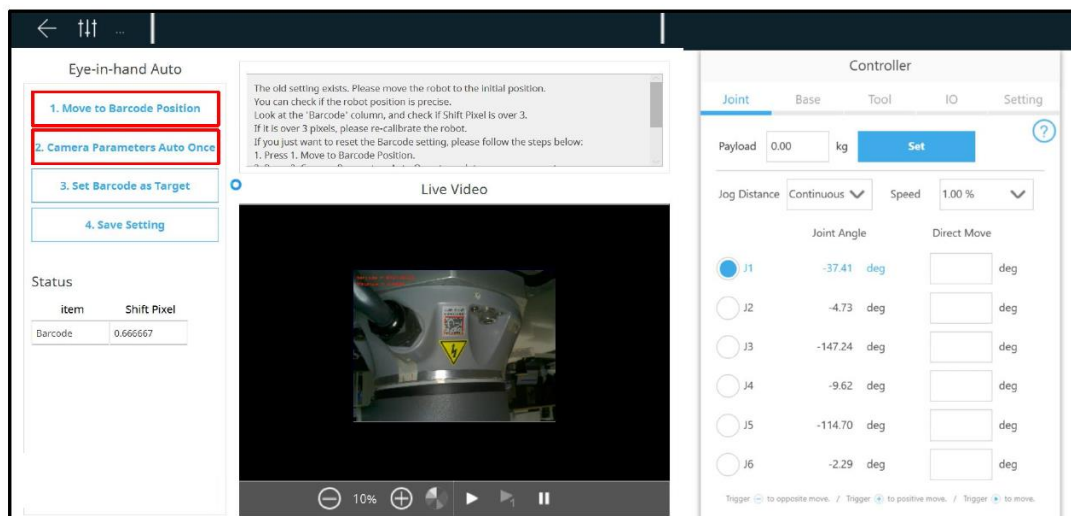
Barcode setting

1. Press 'Set Barcode as Target' to save the present barcode location.
2. Press 'Save setting' and finish the calibration.

10.8 Save the calibration data

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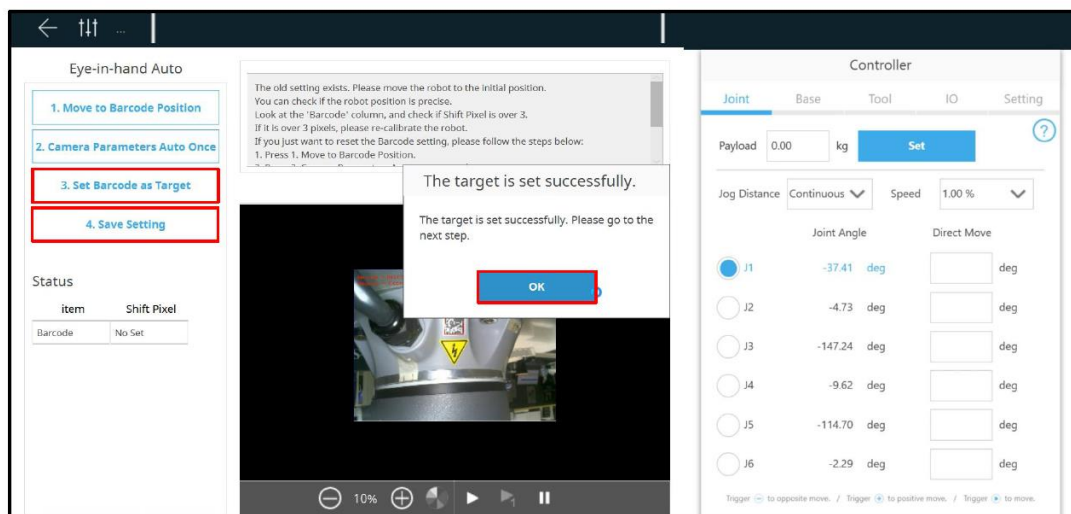
Save the calibration data

1. Go to 'Maintenance mode', select 'Safety'
2. Enter 00000000 and select Login, and then press 'OK'

Save the calibration data

1. Press 'Set' to upload the calibration data from control box to arm
2. Press 'OK' and the TMflow will shut down automatically

10.9 Snake dance

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Snake dance_TM25S, TM30S

1. Run the **TrialRun** from Run setting for 30 minutes.

⊙	@TMField_TrialRun	100%

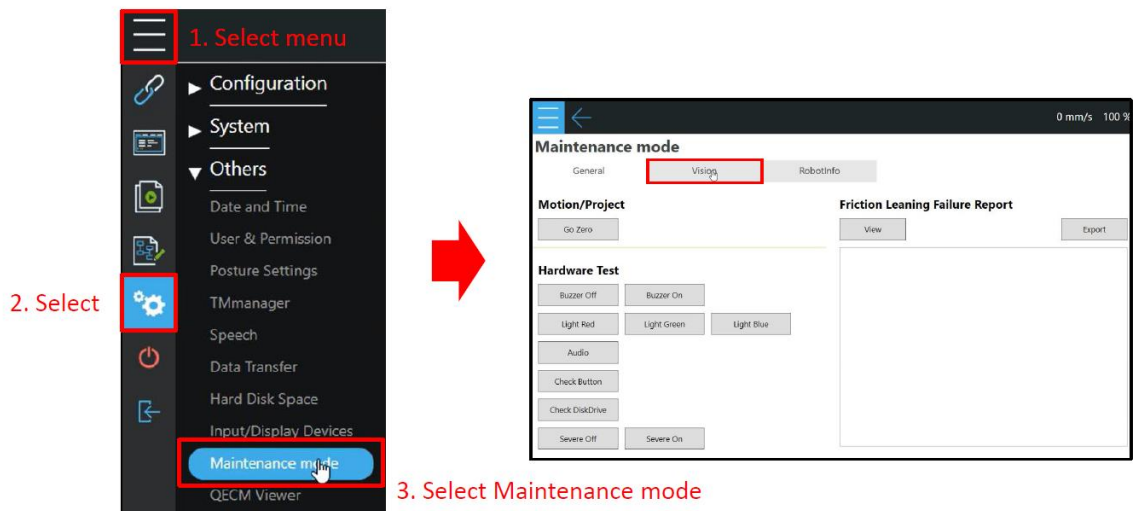2. If there is no abnormality after the test, the robot is ready for use.

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11. Trouble shooting

11.1 Camera disconnection

Symptom description	EIH camera disconnected while using / EIH camera can not be detected
Possible causes	This issue may be caused by following reasons/components: 1. IPC 2. Internal complex cables 3. Robot cable 4. Camera cables inside the robot arm 5. TRI camera 6. System or driver
Symptom photos Or Error codes	0x00020000 0x00020003
Notices	

Camera Lost Connection

Yes
No

Step 1
Refresh camera list in HMI to check if there is any camera which can be detected.

System delay, please keep monitoring

Step 2
Execute TriCameraSimpleUI64 program, and check if the FOV has Image or not

HMI Bug. Please contact Techman or distributor.

Step 3
Check if the Green light of RJ45 connector on IPC is flashing or not.

Step3a
Software
Check the Network Interface Card(Ethernet2)for TRI camera exist and open or not.

Open the Network Interface Card for TRI Camera

Step 3d
Plug RJ45 cable of camera into another port of IPC, and check if camera can be detected.

IPC RJ45port is abnormal,change IPC。

Step 3b
Check the Techman NDIS Light Weight Filter exist and choose or not

Choose or reinstallTechman Robot NDIS Lightweight Filter Driver.

Step 3f
Use electric meter to measure the TRI camera power voltage, check if the value is 5V or not

Step 3e
Open Ethercat2 Status, check if the internet speed is 1.0 GB or not.

Change TRI Camera

Step 3c
Check the IP setting is DHCP or not

Change the IP setting to DHCP.

Replace RJ45 Cable one by one,and check the data light.

Change IO Module Mainboard.

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TriCameraSimpleUI64

The TriCameraSimpleUI64 executable file is on the Control Box above HMI Vesion2.0.

Execute the following path file
D:\TRI_Camera\TriCameraSimpleUI64.exe

Step
1. Showing the camera
2. Connect (click)
3. Continuous(click)
4. Check if there is image on FOV
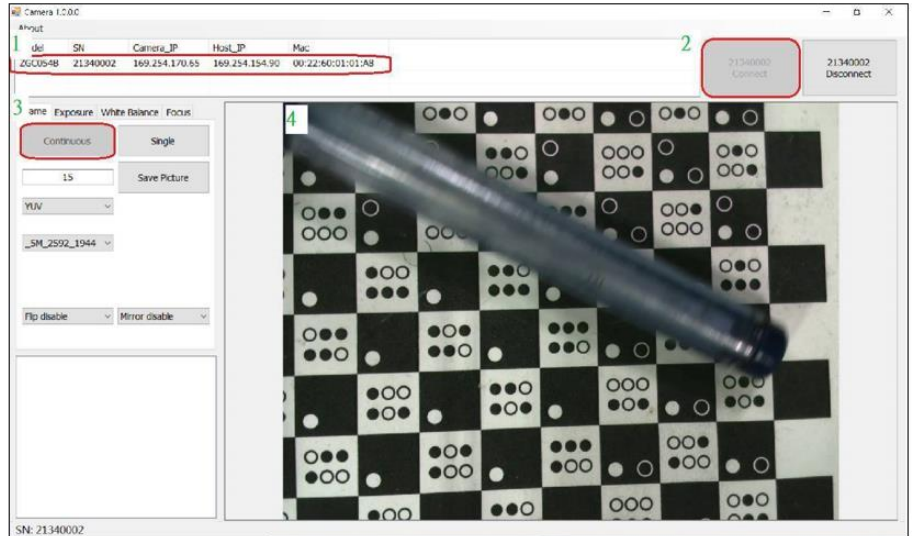
Check camera port on IPC

Check if the RJ45 Cable port on IPC flashes or not

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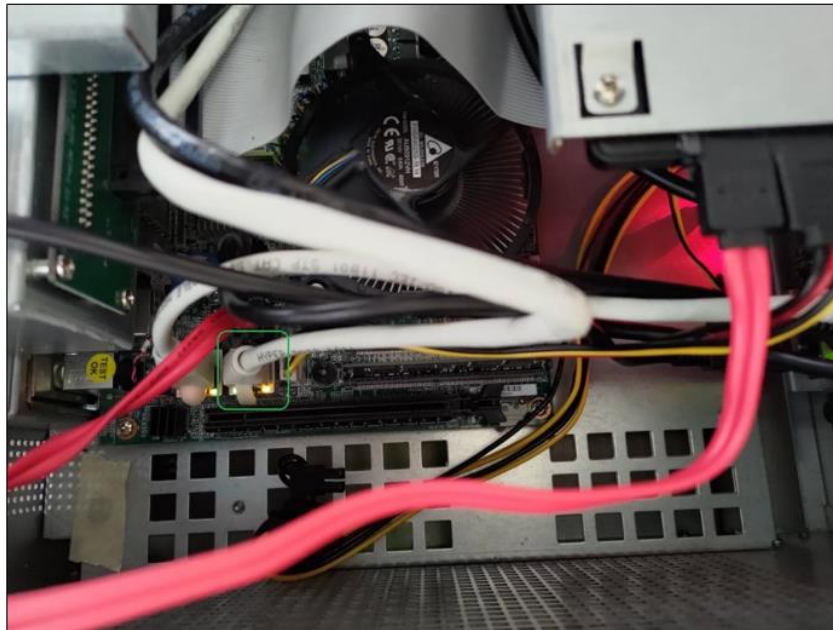
Check Network setting_1

1. Go to Control Pane -> Network and Internet -> Network and Sharing Center -> Change adapter settings
2. Check whether the Network Interface Card(Ethernet2)for TRI camera exists or not, and it should be activated.
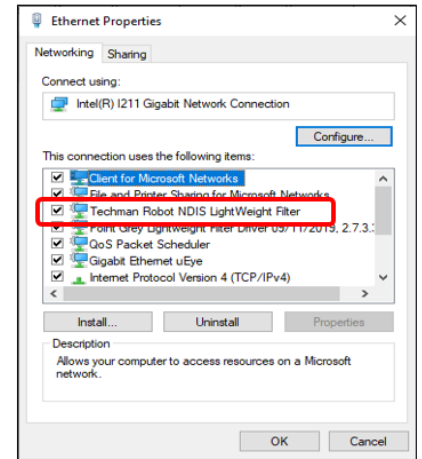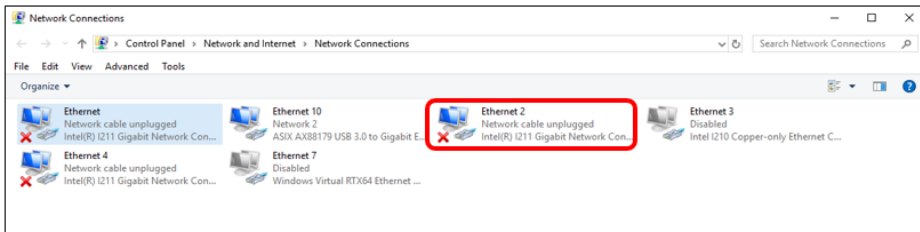
3. Right click the Ethernet2 and choose properties, check whether the Techman NDIS Light Weight Filter exists or not.

Check Network setting_2

1. Choose Internet Protocal version4 and then choose properties. Check whether the IP setting is DHCP, set it as DHCP.

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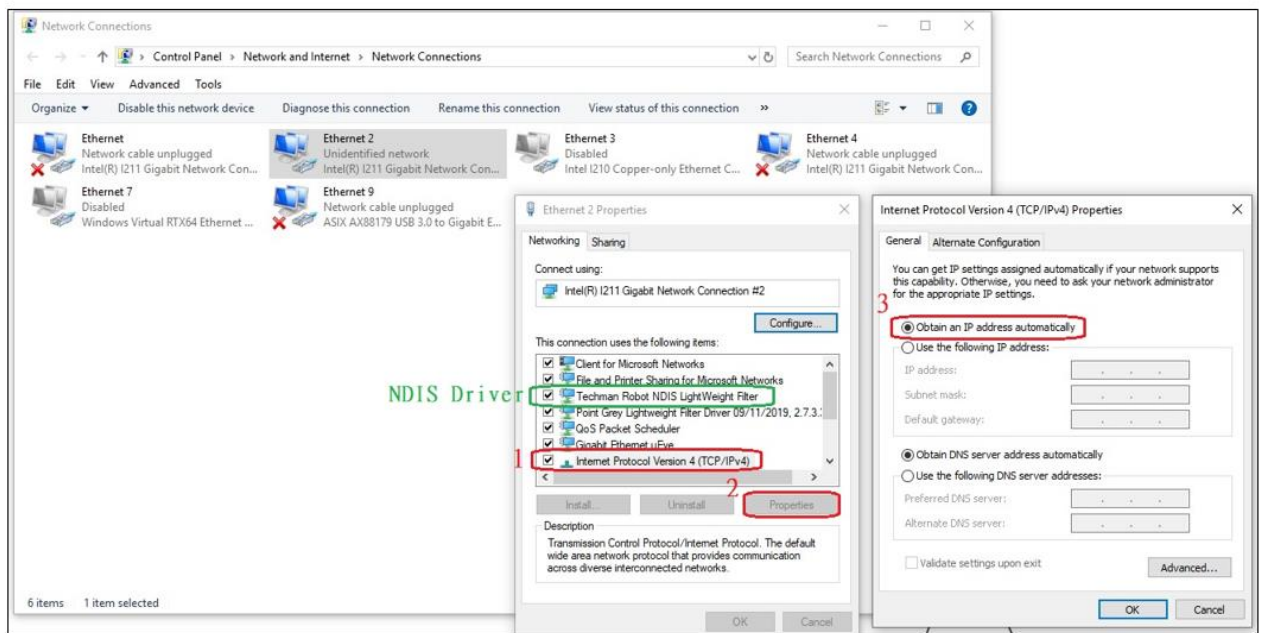
Check Network setting_3

1. Choose Ethernet2, and check whether the Ethernet Speed is 1.0 Gbps or not; if not, it means the problem could be caused by hard ware components.
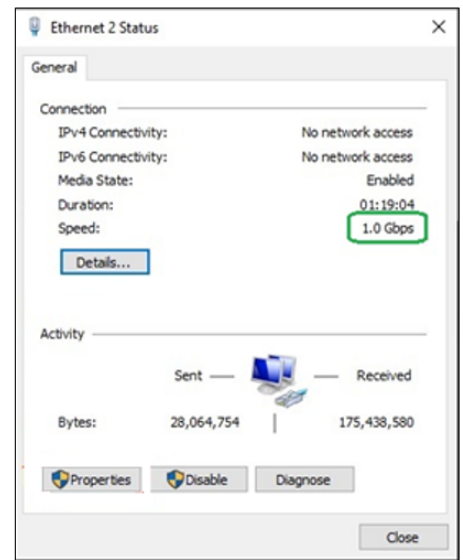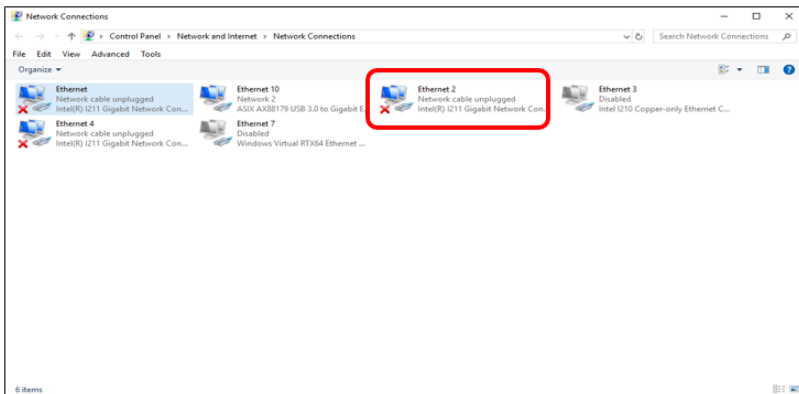
Check TRI camera

1. Follow Picture 1 to remove the Camera housing.
2. Use multi-meter to measure the TRI camera power voltage, check if the value is 5V or not as picture 2 & 3

Picture 1 - Remove camera housing screw

Picture 2 - Measure TRI camera Power

Picture 3 - Measure pins

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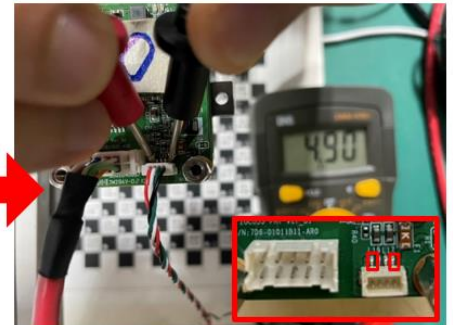
Check TRI Camera_LED indicators

1. The orange light on the left indicates link status, signifying that the RJ45 signals on both sides(IPC and TRI camera) are connected.

2. The yellow light on the right represents data, and it illuminates when data is being transmitted.

3. When capturing a picture, the blinking frequency will be faster. In principle, please use the data light to verify whether the TRI camera Ethernet is active or not.

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11.2 Camera won't focus

Symptom description	EIH camera can not focus by HMI adjustment
Possible causes	This issue may be caused by following reasons/components: 1. HMI 2. Camera
Symptom photos Or Error codes	N/A

Notices

The camera can't focus

Yes
No

Step 1
Click auto focus function in camera kit of vision setting. Check whether the camera can focus or not.

System delay, please keep monitoring

Step 2
Enter Windows and use TriCameraSimpleUI64 to adjust the focus

Camera driver Error, please contact with TM

Camera Error, please replace camera

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11.3 Point offset

Symptom description	The robot cannot reach the previous position after a collision or for an unknown reason. This issue typically arises following a collision or relocation.
Possible causes	This issue may be caused by following reasons/components: 1. Joint 2. End module 3. Surrounding equipment
Symptom photos Or Error codes	N/A

Notices

```
┌─────────────────────────┐        ──→ Yes
│      Point offset        │        ──→ No
└─────────────────────────┘

Step 1
┌─────────────────────────┐      ┌─────────────────────────────────┐
│ Check if the workspace   │ ──→  │ Ensure the robot is securely    │
│ or the robot is shaking  │      │ mounted on the workspace, and   │
└─────────────────────────┘      │ the workspace is stable without │
                                  │ any shaking                     │
                                  └─────────────────────────────────┘
Step 2
┌─────────────────────────┐      ┌─────────────────────────────────┐
│ Check if the pin holes   │ ──→  │ Reinstall the joints. if the    │
│ of joints have shifted   │      │ issue persists, contact Techman │
└─────────────────────────┘      │ for assistance.                 │
                                  └─────────────────────────────────┘
Step 3
┌─────────────────────────┐      ┌─────────────────────────────────┐
│ Set the robot arm to the │ ──→  │ Replace abnormal joints         │
│ home pose and observe    │      └─────────────────────────────────┘
│ for any noticeable tilting│
└─────────────────────────┘
Step 4
┌─────────────────────────┐      ┌─────────────────────────────────┐
│ Create a project and set │ ──→  │ Continuous observation          │
│ 4 points, make the robot │      └─────────────────────────────────┘
│ run the project repeatedly│
│ for about 20 minutes to  │
│ see if the points shifted│
└─────────────────────────┘

┌─────────────────────────┐
│ Send the robot back to   │
│ TM for inspection        │
└─────────────────────────┘
```

Note 1: If the joint is misaligned but can still complete Step 4 without triggering other errors or abnormalities, users can attempt to adjust the position and continue using it.
Note 2: If the joint is already misaligned, it cannot be restored by any calibration steps.

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11.4 Control box fails to boot up

Symptom description   Control box fails to boot up after pressing the power key on the stick

Possible causes   This issue may be caused by following reasons/components:
1. Stick
2. Relay board
3. 24V PSU
4. Patriot power board

Symptom photos Or Error codes   N/A

Notices

No reaction from control box after pressing the power key on stick

→ Yes
→ No

Step 1
Check if the control box can be booted up by using the remote power ON/OFF? → Replace Stick

Step 2
Check if there is enough AC input and output(to 24V PSU) on relay board → Replace Relay board

Step 3
Check if there is enough DC output from 24V PSU to Patriot power board → Replace 24V PSU

Replace Patriot power board

Note 1: During troubleshooting, also check the stability of the installation of external AC power, relay board, 24V PSU, power board, and stick, as well as other hardware cables.

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11.5 Encoder Error

Symptom description   TMflow shows messages relating to encoder error or encoder compensation error

Possible causes   This issue may be caused by following reasons/components:
1. Joint

Symptom photos Or Error codes   0xFFCE / 0xFFED / 0xFFE4

Notices   When encountering Encoder-related anomalies, determine which joint is causing the issue based on the Error code displayed in TMFlow, and request replacement for the affected joint.

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11.6 Robot arm does not activate

Symptom description	There is no power supply from the control box to the robot arm, and the indicator light ring on the end module does not illuminate even after the control box has been booted up.
Possible causes	This issue may be caused by following reasons/components: 1. Power relay board 2. 48V PSU(Power supply) 3. Patriot power board 4. Power eater 5. Joints 6. End module
Symptom photos Or Error codes	0x3E / 0x53 …
Notices	When addressing this 48V circuit issue, we recommend starting by disconnecting the robot and control box. This step will help you identify and narrow down the range of components that need to be checked.

→ Yes
→ No

48V power error; Turn off the control box and disconnect the robot cable. Reboot the system.

Step 1
Check if the problem remains by using Debug port or observing LED indicator lights(A3).
You can also verify if the error code has changed in TMflow.
*In normal conditions, removing the robot cable will display Error code 0x3C.

Problem occurs at control box

Replace relay board

No power output

Step 5
Turn off the control box. Before powering up, set up a multimeter to the output connector of the relay board leading to the 48V PSU. Measure if there is sufficient voltage output during startup.

Problem occurs at robot arm

Step 2
Disconnect the 48V wiring between Joint 3 and Joint 4 while the control box is off. After rebooting, check if the problem remains.

Step 6
Turn off the control box. Before powering up, set up a multimeter at the 48V input of the Patriot power board. Measure if there is enough voltage input during startup.

Problem disappears

Problem remains

No power output

48V output

Step 3
Problem occurs at Joint 1 ~ 3, disconnect them sequentially.

Step 4
Problem occurs at Joint 4 ~ End module, disconnect them sequentially.

Replace 48V PSU

Replace Patriot power board

11.7 TM Safe error

Symptom description	Can not access TMflow normally, showing error codes below.
Possible causes	The error may be caused by following reasons/components: 1. Joint 2. Patriot power board
Symptom photos Or Error codes	0xCE, 0xCF, 0x4E017, 0xDD28, 0x45F071, 0x55F071, 0x65F071, Open RTSS Fail
Notices	When addressing this trouble shooting, we recommend starting by disconnecting the robot and control box, and check if the error code changes. This step will help you identify and narrow down the range of components that need to be checked.

→ Yes
→ No

Turn off the control box and disconnect the robot cable. Reboot the system.

Step 1

If the error showing on TMflow changes?

Error remains

Step 5

Contact Techman

Error code changed into 0x3C, which means the error was caused by robot arm

Step 2

Shut down the robot, disconnect the EtherCAT signal cable between Joint 3 and Joint 4, then reboot the robot.

Step 4

The error code changes to 0xCE, 0xCF, 0x4E017, 0xDD28, 0x45F071, 0x55F071, 0x65F071, or 'Open RTSS Fail', indicating errors between Joint 1, Joint 2, and Joint 3. To identify the faulty components, sequentially disconnect from Joint 1 to Joint 3.

Step 3

The error code remains 0x3C, indicating the error occurred between Joint 4 and the End module. To identify the faulty components, sequentially disconnect from Joint 4 to the End module.

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11.8 Torque error

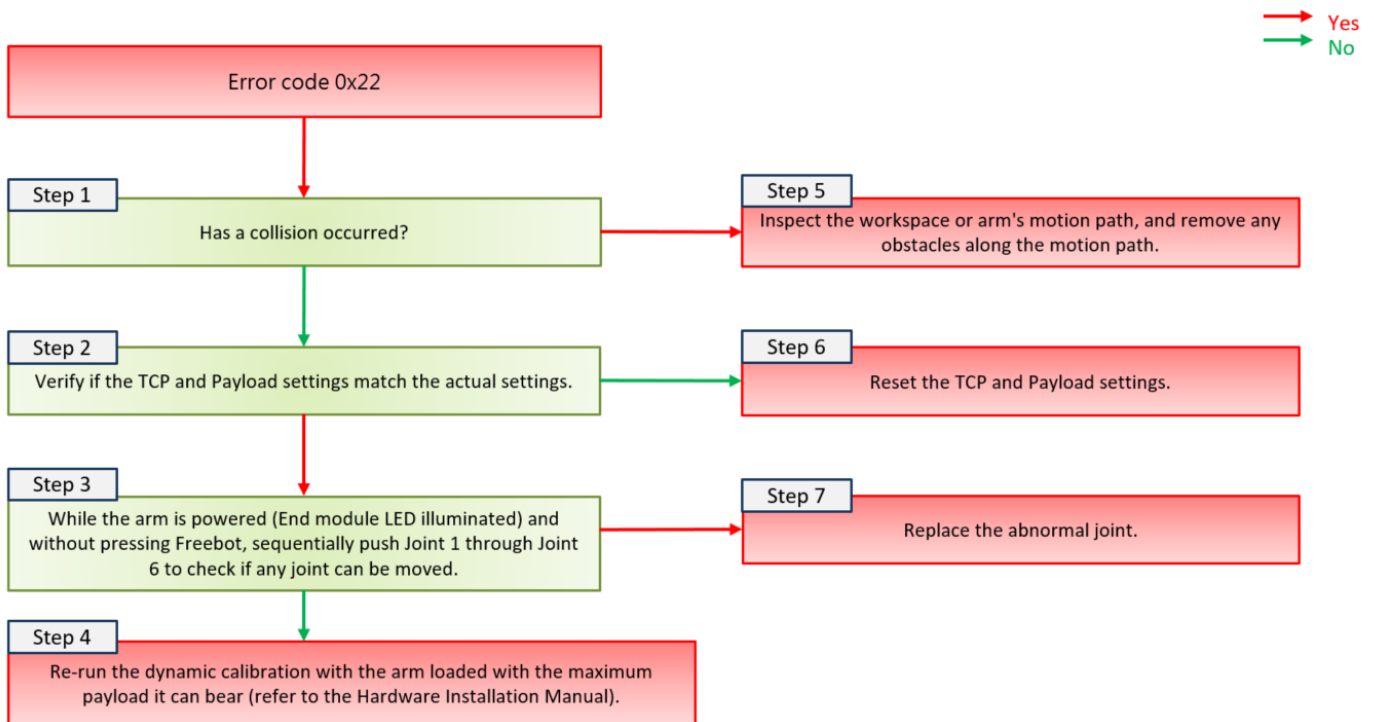|	
Symptom description	During robot operation, it displays that torque limits exceed the standard.
Possible causes	The error may be caused by following reasons/components: 1. TCP settings do not match reality 2. Obstacle or interference detected along the arm's motion path 3. Abnormality in joint 4. Safety parameter abnormality
Symptom photos Or Error codes	0x22, 0xFF08, 0xFF0B, 0xFF0E, 0xFF11, 0xFF14, 0xFF17, 0xFFCF
Notices	When addressing this trouble shooting, it is recommended to first check whether there is any interference with other objects along the arm's motion path. Prolonged interference or collisions may lead to a shortened lifespan of the Harmonic Drive within the joint."

→ Yes
→ No

Error code 0x22

Step 1 — Has a collision occurred?

Step 5 — Inspect the workspace or arm's motion path, and remove any obstacles along the motion path.

Step 2 — Verify if the TCP and Payload settings match the actual settings.

Step 6 — Reset the TCP and Payload settings.

Step 3 — While the arm is powered (End module LED illuminated) and without pressing Freebot, sequentially push Joint 1 through Joint 6 to check if any joint can be moved.

Step 7 — Replace the abnormal joint.

Step 4 — Re-run the dynamic calibration with the arm loaded with the maximum payload it can bear (refer to the Hardware Installation Manual).

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11.9 Kinematic calibration failed

Description	Kinematic calibration failed
Possible causes	1. Camera malfunction. 2. Landmark abnormality. 3. Joint malfunction or incorrect joint assembly.
Error code	NA

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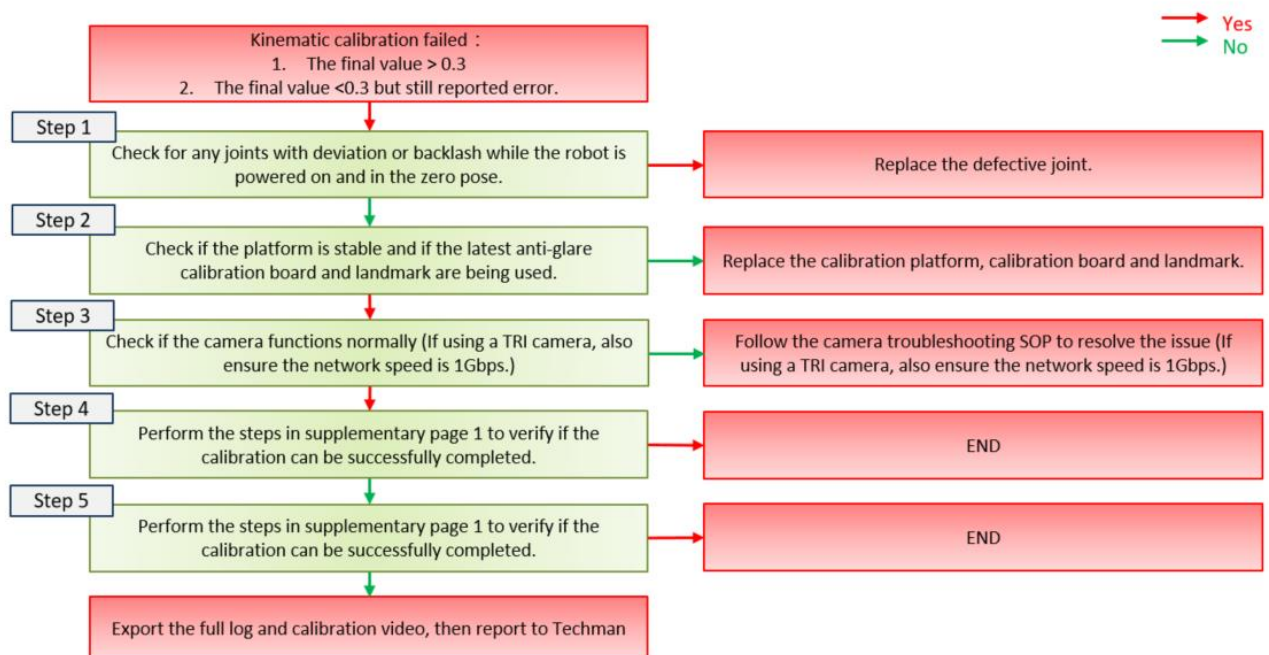
9. Kinematic calibration failed _ supplementary page 1

1. Navigate to the path: D:\Robotfile
2. Back up the following files and delete them: deltaDH0.bin, deltaDH0.txt, Driveroffset0.bin, Driveroffset0.txt
3. In the D:\Robotfile directory, create the following files: EEPROMUPDATE1.txt & EEPROMUPDATE0.txt
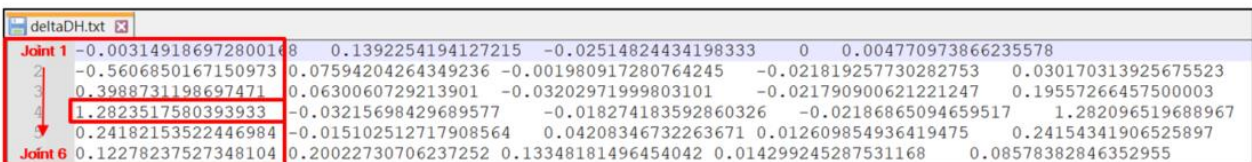4. Create a new file named DeltaDH0.txt, and enter the required values:

5. Create a new Driveroffset0.txt and input the following values:
   HW1 – HW3.2: -45.00000000,0.00000000,0.00000000,0.00000000,0.00000000,0.00000000
   HW5: 90.00000000,0.00000000,0.00000000,0.00000000,0.00000000,0.00000000,
6. Reboot the system and perform the calibration again.

9. Kinematic calibration failed _ supplementary page 2

1. Navigate to the path: D:\CalibrationData
2. Open deltaDH.txt and check if any values are greater than 1. If any values are greater than 1, reassemble the corresponding joint.
(For example, in the case of following image, Joint 4 needs to be reassembled.)

1. If the calibration still fails after reassembling, and the value at that position is still greater than 1, replace the joint.

11.10 Hand-eye calibration failed

Description	Hand-eye calibration failed
Possible causes	1. Landmark abnormality. 2. Camera parameter abnormality
Error code	NA

→ Yes
→ No

```
Hand-eye calibration failed
        │
        ▼
Does the calibration procedure complete?
   │                              │
Yes, but the values          No, and the final values were not displayed.
exceed the specified range.
   │                              │
   ▼                              ▼
Value 0.3-0.4: Redo 8cm       If the version before 2.22 being used, and is
to 15cm Camera calibration    the model TM5, TM5S or TM7S?  ──► Place the Landmark 90mm
and Kinematic calibration.         │                              away from the camera
Value >0.4: Redo Kinematic         ▼                              (refer to calibration manual)
calibration.                  Is version 2.18 being used?  ──►   and perform calibration
   │                                                              again.
   ▼                                                         
If the issue cannot be resolved,                             Apply patch and perform
export the full log and                                      calibration again.
calibration video, then report
to Techman
```

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